THE MATHEMATICS PROGRAM
OF THE
DENVER PUBLIC SCHOOLS
Kindergarten Through Twelfth Grade

GRADES TWO AND THREE

Written under the auspices of
The Mathematics Program Committee

by

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Produced by
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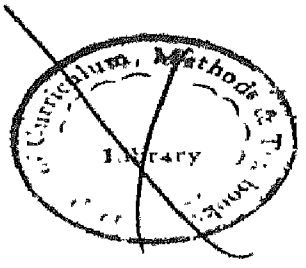

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This volume of the Mathematics Program of the Denver Public Schools, Kindergarten Through Twelfth Grade, incorporates a revision of the program and the material previously published in the Mathematics Handbook. It replaces the former separate publications and should be ordered for every teacher of grades two and three. Cost of the books will be charged to the 244 account of the ordering school.

DENVER PUBLIC SCHOOLS
1957-1958

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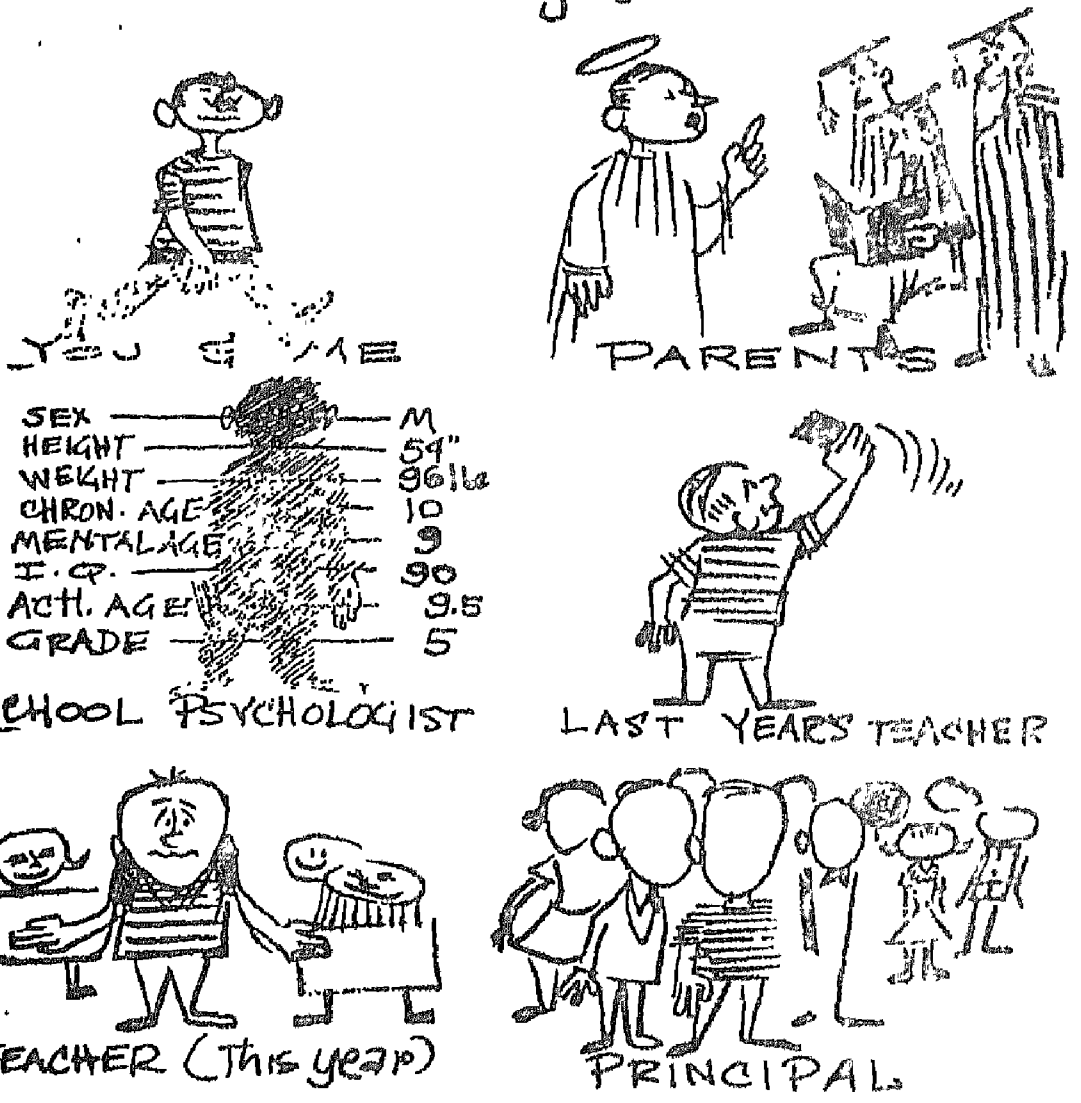

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Each of the individuals concerned with the child's attainments in arithmetic has sound reasons for his own views.

And all of them share an interest in the pupil's welfare and academic success.

INTRODUCTION

The principles that have guided the preparation of this manual are given below. Many authorities believe that acceptance of and adherence to these principles will help teachers teach mathematics more meaningfully.

Mathematics is primarily the study of relationships

Emphasis should be placed on what is done with numbers, not on the numbers themselves. We learn to work with numbers as a means to the important end of quantitative thinking or problem solving.

Computation, then, should be viewed in its proper perspective. It is the tool that is used, and will continue to be used, by the pupil in thinking through a quantitative situation to its solution, and a solution to most situations can be found by using one of several computational processes. There may be only one correct solution, but there are usually several routes to it.

Pupils should be led to discover that number values are mutually dependent in problem situations. They should realize that the information they are seeking is dependent upon or related to some information that they already possess or can obtain.

The greatest motivation for and success in problem solving will result from pupils' attempts to solve actual problems. If pupils are helped to examine critically the processes they use in solving problems, experience can be an effective teacher.

Conceptual learning should precede drill

Liberal use must be made of concrete and semiconcrete materials if pupils are to understand the processes which involve numbers.

Drill should follow conceptual learning. A set of operations becomes related to a set of symbols only through practice. Rationalization reduces but does not replace drill.

To be most effective, drill should be distributed. Practice periods that are gradually reduced in length and in frequency should follow the teaching or reteaching of a process

Children's concepts mature slowly

Children's concepts do not mature at each grade level. They should be treated as evolving concepts that require the cycle type of treatment. Proper techniques of evaluation will reveal those concepts that require reteaching and those that require only review and spaced drill.

A teacher should plan his own program of teaching, reteaching, and drill so that it makes the largest possible contribution to the spiraling development of pupil concepts. Hence, it seems essential for each teacher to be familiar with the work undertaken in the grades immediately preceding and following his own level of teaching.

Mathematics vocabulary is the responsibility of the mathematics teacher

Teaching the specialized vocabulary of mathematics is the responsibility of the mathematics teacher. Vocabulary development is a continuous process. Many words and terms introduced in one grade will require further teaching in succeeding grades.

At every grade level, numbers are taken apart, put together, and compared. If the results of these processes are to have more precise meanings at the higher grade levels, they must be expressed in more precise words and terms.

Well-rounded programs of instruction and evaluation are needed

Both the instruction and the evaluation program in mathematics should be well rounded. In addition to the usual paper and pencil computation, these programs should include the use of "oral" or "mental" arithmetic, capitalizing on the fact that our number system is based on ten.

Many situations should be provided in which approximate answers rather than exact numerical answers are required. ("About one-half" is often a more practical answer than is ".5126" or "51¼%.")

Mathematics should be presented in a variety of forms and a variety of language. For example, pupils should be led to understand that subtraction may be involved in any of the following questions: How much is left? How much longer? How much shorter? How much more? How much less? What is the difference?

The interpretation of numbers and number operations in areas of social living should be stressed. Pupils need to be taught, for example, how to interpret correctly such statements as "the annual precipitation is 50 inches" and "the yearly budget exceeds 80 billion dollars."

THE MATHEMATICS PROGRAM OF THE DENVER PUBLIC SCHOOLS

Objectives

The Denver Public Schools seek to provide through the K-12 Mathematics Program an opportunity for each child, as an individual, to attain his maximum growth in quantitative thinking and to increase his total effectiveness as a contributing member of the democratic society. To reach these goals, the program of mathematics will make available to every pupil experiences that will enable him to acquire

- The ability to refine his mathematical concepts, methods of thought, and problem solving techniques
- Knowledge of the decimal number system and an introduction to other number systems and their significance
- Competence with an understanding of the four fundamental processes of arithmetic involving integers, fractions, decimals, and the uses of elementary algebra
- Understanding of the general properties of geometric figures, their relationships, and their uses
- Basic knowledge about and ability to appraise commonly used statistics
- Reading habits and study skills appropriate to mathematical material and ability to use mechanical devices of a mathematical nature
- Ability to understand and use common systems of measures and methods of graphing to compare quantities

- Understanding and appreciation of the part mathematics has played in the development of culture, the changes it is making in present day living, and its potential for the future development of society.

Philosophy

A perusal of this guide will enable those responsible for teaching children at any level to have a comprehensive view of the entire K-12 Mathematics Program. Moreover, it will enable them to see how the foundation for quantitative thinking is carefully laid through progressive experiences in the very beginning of the elementary school, and how each of these experiences is built upon to refine and expand those foundations by continuing experiences throughout the thirteen years of school. Finally, they will see that by this continuous progression from simple meaningful concepts and understandings, facility with abstract quantitative thinking is ultimately attained.

Teachers using this guide will discover that number facts and algorisms have an important place in the program. However, they are presented and assimilated only as refinements and by-products in the development of a system of quantitative thinking and understanding. Insight and understanding are the goals. It is recognized that at any given grade level pupils will possess varying degrees of maturity and ability. It is proposed that each learner be given the opportunity to attempt the program and advance to his maximum expectancy. The important consideration at all levels of maturity is that new insights are gained before new number facts are learned; that generalizations and understandings are discovered and applied before processes are memorized.

Approach to Teaching

The achievement of these goals will depend largely on the approach and on the use of methods by which meanings become clear, accurate, and progressively more refined. Insight and understanding in mathematics increase the pupils' ability to quantify which is, after all, the ultimate aim of the mathematics program. In addition to specifying content for each grade level, this guide places emphasis on the progressive steps necessary to develop the concepts, understandings, insights, and skills necessary for quantitative reasoning. These steps are

Development

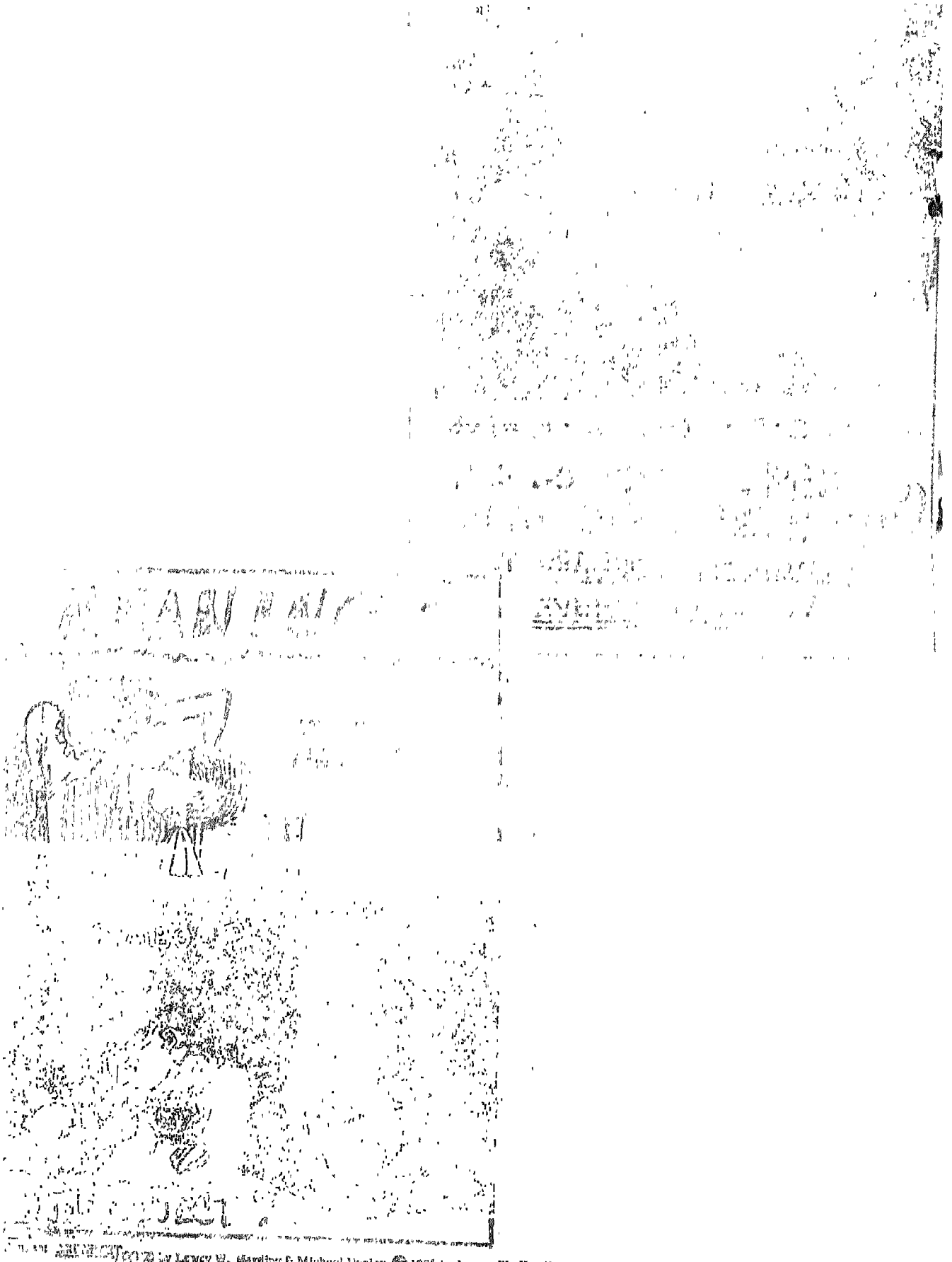
Practice

Drill

Well-spaced review and maintenance activities.

The guide, then, follows the philosophy that insight and understandings should lead to the developing of computational skills and processes necessary for quantitative reasoning and problem solving. The K-12 program is based on the premise that the work of each level of instruction from kindergarten through twelfth grade contributes to the pupils' total mathematical insight and achievement.

Learning in any area is not a spontaneous act. On the contrary it is a continuous progression through meaningful experiences that are closely related to the learners' everyday living. Learning involves relationships and deep understandings. It involves reorganization of previously learned ideas to solve progressively more difficult problems so that higher and higher levels of performance are attained.



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The complete cycle in developing a mathematical understanding involves these important steps:

- The desired learning should make sense to the learner.
- Activity leading to conclusions should be provided.
- Activities and discussions should lead the learner to refine his experiences into acceptable conclusions or rules.
- Sufficient meaningful practice should be provided for him to gain intelligent control of his conclusion.
- Drill should be provided for mastery.
- This learning should be used as a stepping stone to a new learning.

Before any new learning is presented it should, first of all, make sense to the learner in the light of his present needs and past experiences. The learner should be actively engaged in the learning either by manipulative devices or representative materials. As he works, he should tell in his own language what he is doing and what is happening to the problem at hand. For example, a third grade class seeks to know how many feet are contained in a yard. They decide to compare a foot rule with a yardstick. Johnnie is given several foot rules and a yardstick. As he fits the rulers to the yardstick, his "play-by-play" account might be like this:

"Here's one ruler down. It goes as far as 12 on the yardstick because it is 12 inches long.

"I can put another ruler here right next to the first one. That's two rulers. I think I have room for one more - maybe.

"Yes, three rulers fit on the yardstick and come out just right. See?"

Johnnie will discuss this activity with his peers, and other experiments concerned with the same learning may be performed. Finally, after several days of experimenting, the learners are ready to generalize on the results

and to deduce a rule that will help to solve other problems: There are three feet in one yard.

In junior high school, experience in measuring the circumference and diameter of circular objects with a tape measure can lead to the discovery that the circumference of a circle is about three times greater than the diameter, and the meaning of π can be established firmly before it becomes a part of a formula.

A period of skillful development is necessary to establish readiness for a new concept, understanding, or process. Following such procedure, the insight or understanding may appear to come almost spontaneously to the learner and needs only to be refined (by teacher and pupil) to become an acceptable rule which he can apply to similar situations.

Plans for using textbooks, worksheets, workbooks, tests, and other instructional aids are outlined in the appendix. Detailed sample lessons showing the complete developmental cycle of certain concepts, understandings, and processes at various levels of instruction are also included. The guide suggests ways in which the understanding of mathematics can be increased by the use of these instructional materials. It also suggests ways of adapting both mathematical content and methods of teaching to varying levels of maturity and ability.

Evaluation

The K-12 Mathematics Program emphasizes growth in quantitative thinking. It outlines certain concepts, understandings, and generalizations which must be acquired from year to year. It suggests that the effectiveness of the program can be measured in terms of changed behavior commensurate with the experiences of the child and the level of maturity he has reached.

Behavior changes can be noted by using one or more of several techniques: periodic testing, observation, and consultation.

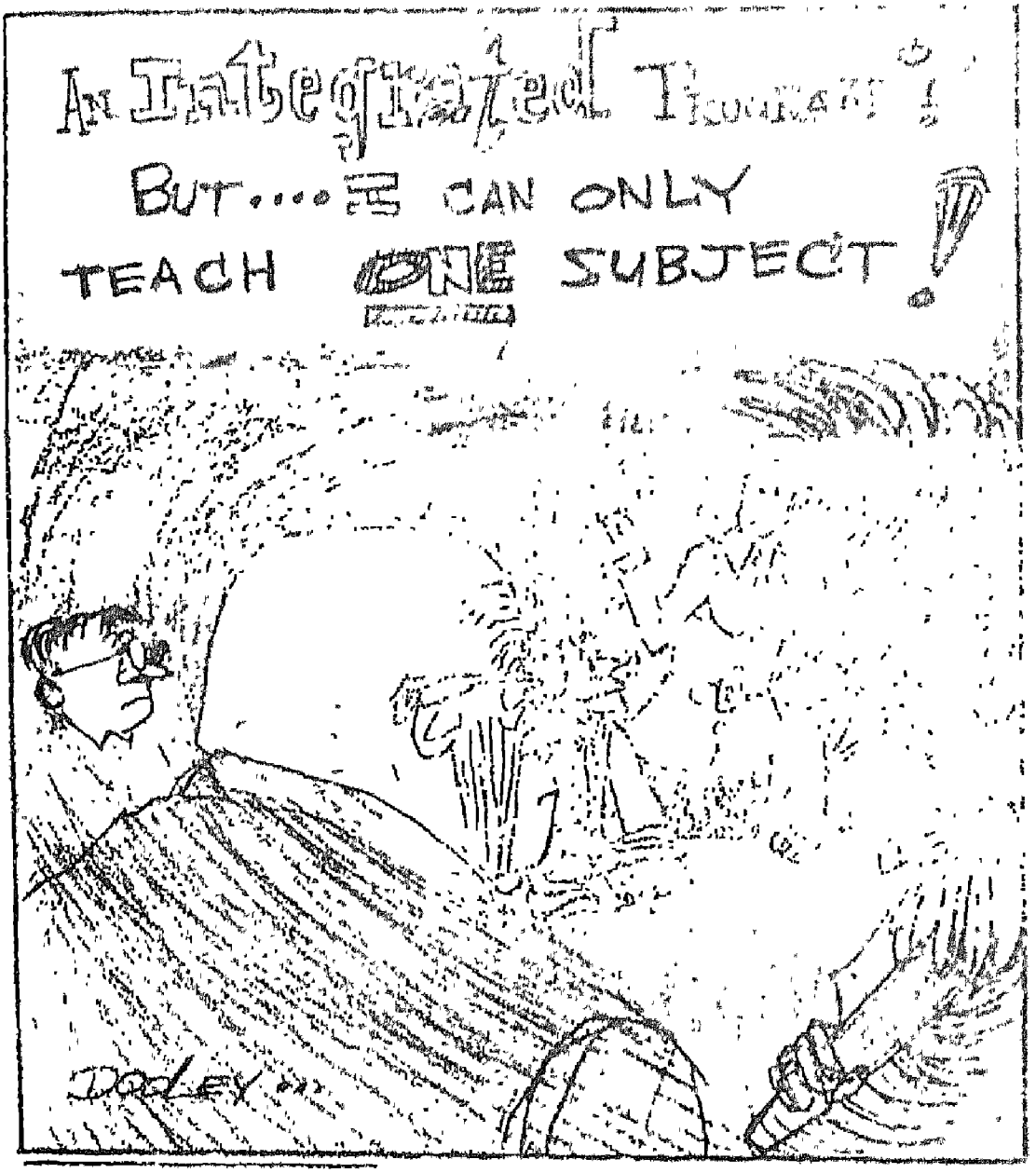
By periodic testing the teacher discovers the achievement the pupil has attained in relation to his expectancy. Pretesting or inventory testing determines a pupil's readiness for new work. Diagnostic and quality control tests reveal individual and group weaknesses and indicate needs for reteaching and mastery. Survey tests determine the affectiveness of the K-12 Mathematics Program in relation to national norms.

Evaluation by observation is often more revealing than test results. It gives the teacher a mental picture of the pupil at work in a day-by-day classroom situation and helps the teacher determine the bases for strengths or weaknesses revealed by the test.

Consulting with a pupil as he works is the most specific evaluation the teacher can make. The pupil's responses reveal his manner of thinking, his attitudes, and habits of work. These help the teacher determine the maturity level at which he is working so that provision may be made for extensions or enrichments as the case requires.

Maintenance

Any activity that enables a pupil to use the mathematical concepts and processes he understands can be regarded as a maintenance activity. There are innumerable situations in the total integrated school program which involve concepts, facts, and skills learned in the arithmetic program. Figuring the total amount of money collected for the Junior Red Cross provides excellent practice for the concept that "adding to" increases quantity, or for using what is known about adding 2-place numbers including money. Other student council projects and school activities offer similar opportunities for maintaining



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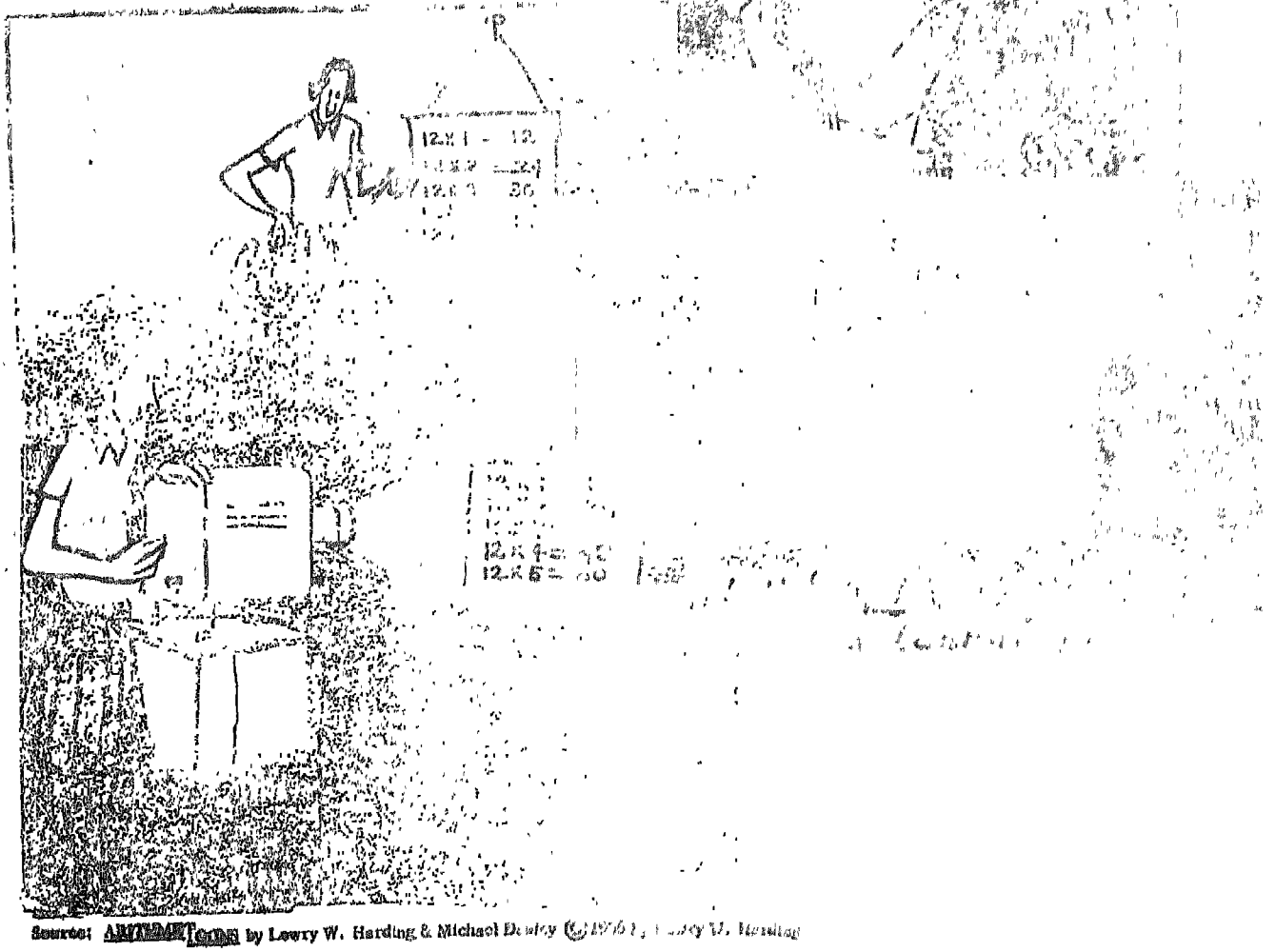
learnings. The same situations may be carried over into the junior and senior high school on a higher level of maturity to involve percentage or ratio.

In addition to integrating arithmetic skills into the total educational program, the teacher should use well-planned and recurring reviews and drills that bring the old skills and facts into new uses. He can also build new concepts on the foundation of those previously learned. This brings the concept into new focus and gives it new meaning to the learner. This guide points the way to maintaining the learnings achieved.

Instructional Aids

In the beginning of a pupil's number experience, objects are very important to the development of concepts because his arithmetic needs are largely restricted to knowing "how many" and "how much." Number is not a property of things. We put the number into things for the young child because he is at the stage of maturity where he is dealing with things in his social situations. He needs an intermediate step to bridge the gap between the social and the mathematical aspects of the situation. This step is manipulative.

The teacher who follows the philosophy of the mathematics program will find that teaching aids adapted to the various levels of learning are essential. But the teacher should always bear in mind that whether the aids used are concrete (counters, fraction cutouts, abacus) or representational (pictures and drawings in textbooks and practice sheets) or symbolic (algorisms in exercise books or drill materials), they are used only as a preparation for a higher level of maturity, abstraction. Only when the learner has emancipated himself from thinking with things has he really acquired the ability to do quantitative thinking.



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Modern teaching aids, when properly used, greatly increase the efficiency of instruction. However, as with any material or process involving human factors in their use, results depend upon the user's ability and creative imagination. The dictionary defines this as "the power of recombining former experiences in the creation of new images different from any known by experience."

Creative imagination appears to be an ability that is not found in every classroom.

The soundness of investment in teaching aids depends first upon the competence of the teacher who will use them.

In the primary grades every teacher should have in the classroom or have easy access to the concrete aids listed below:

Wall chart of digits 0-9

Counters, counting blocks, simple abacus

Pocket charts, tens and ones counters

Large flannel or felt board with felt accessories, including fractional parts of 1/2, 1/4, 1/3

Measuring tools

Foot rule with inch markings (expand to 1/2, 1/4 inch)

Yardstick, tapeline

Scale, egg cartons, containers of varying shapes and sizes from 1/2 pint to 1 gallon

Standard measuring cup and spoons

Thermometer, clock (real), clock face with movable hands, toy money, toy cash register.

For the upper elementary grades these are essential:

Pocket chart

Abacus or tens counting frame or board

Fractional wheels and equivalent charts

Footrule with markings to 1/8 inch

Measuring tapes of varying lengths, including one with decimal markings

Measuring cups and spoons

Standard containers, pint, quart, gallon, peck, bushel

Cards of squares (square inch, square foot, square yard for volume and area)

Scales

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Overheard in the hallway, from a determined but unimaginative veteran of the classroom:

"Yes, I know what they say. Trips, projects, and children's real-life problems such as budgeting allowances and collecting on newspaper routes would make good instructional material. But I know that stuff won't work with the kids I have. They've got to stay in the book 'til they get through every page of it."

Packages (weighing 1 lb., 2 lbs., 5 lbs., 10 lbs.)

Thermometers

For enrichment, these may be needed:

Speedometer, odometer, calipers, cyclometer, pedometer, sandglass, stop watch, sundial, packages of various weights and sizes, food cans of various sizes

In the junior high school, materials listed for upper elementary school will be needed for reteaching. In addition, tools for measurement of surface and volume are essential.

Place of Textbooks and Other Printed Materials

The K-12 Mathematics Program makes many suggestions for developing beginning number understandings and concepts with and without the use of textbooks. These suggestions serve only as models since the teacher should supply number awareness in all the activities of a school day. For example, when passing books for a reading class, the directions "Please get the books" does not make use of the opportunity to build number awareness. But, when the teacher says, "Please get as many books as there are children in the first row," an awareness of one-to-one counting is developed.

Since the newer textbooks are designed to present arithmetic concepts and understandings in a colorful, concrete, and meaningful way as recommended in the program, there need be no conflict in using the K-12 program and adopted textbooks together even though the content and method of presentation may be different.

The following plan is recommended for the use of arithmetic textbooks and other printed materials in presenting new concepts:

Present the concept independently of the textbook, using a real situation or a situation that has interest for the group.

Develop the concept with children working with concrete objects, when possible, until the meaning is clear.

Connect the concrete understanding to symbols, using paper, the chalkboard, or both, and the continuing active participation of the class.

Now, select the work that is appropriate to the concept from the textbook. This provides a reteaching period and affords another approach to the understanding or concept. Textbooks should extend and supplement the learnings and help to bring insights that lead to algorism.

Teachers must help pupils develop the ability to read and understand the directions and explanations in an arithmetic textbook. Pupils should be taught and encouraged to use the textbook as a resource book to which they can refer for self-help in the solving of problems involving previous computational learnings.

The Exercise and Problem Books of the Denver Public Schools, along with any approved workbooks, should be used for meaningful practice, extension, and enrichment after concepts and understandings have been developed. Presenting the work in these materials, again provides the teacher with an opportunity for a reteaching period and affords still another approach to fixing the concept and understanding.

Individual Differences and Standards of Achievement

The Denver Public Schools K-12 Mathematics Program should be studied, topic by topic, by all pupils. The level of maturity of the learner will determine the standards of achievement and the rate of his progress.

Every pupil should be encouraged to use each new learning to the fullest extent of his ability and maturity. The able and more able pupils should proceed more independently toward abstract thinking, algorism and problem solving, and shortcuts of their own. The retarded, slow, or less able pupils may be able to progress only through the manipulatory or partly-symbolic level. This is the level of computation with little or no ability to do quantitative reasoning.

The less able pupil may need to solve a multiplication exercise involving a two-place multiplier using the following steps:

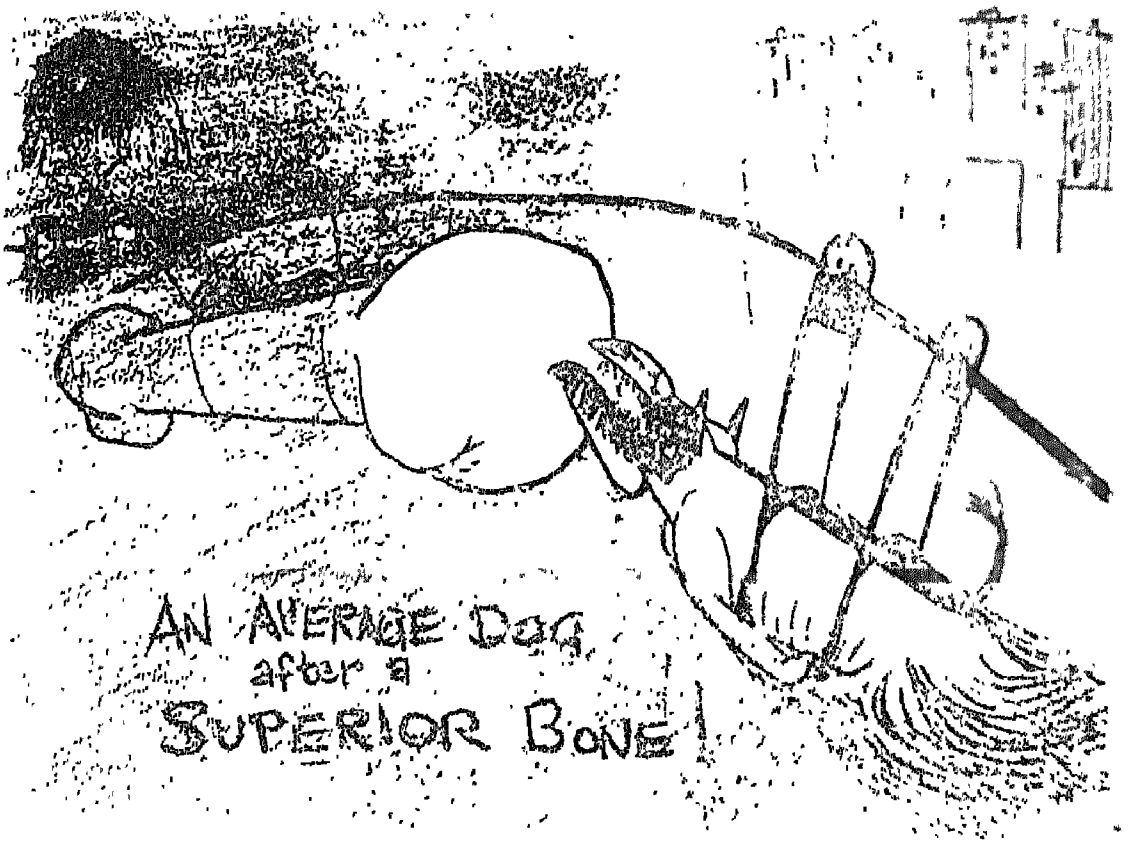
a	b	c	d
74	74	74	444
x 36	x 6	x 30	+ 2220
	444	000	2664
		222	
		2220	

From this level he may progress to using the zero as a place holder in the tens partial product.

```
  74
  36
 444  <-------- 6 x 74
2220  <-------- 30 x 74
2664  <-------- 36 x 74
```

Some pupils may never progress beyond this maturity level, while the more able pupil may be ready to apply the generalization that the right hand or first figure of each partial product is written in the same column as the figure by which it is multiplied.

```
  74
x 36
 444
222
2664
```



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Expecting more of children than they are equipped to produce or achieve tends to put an undue burden upon them. The resulting strain prevents them from reaching even the normal attainments of which they are capable.

Even though all pupils follow the same course of study, the approaches to their learning will necessarily differ as will the achievements. Pupils learn best by doing and thinking, with skills following understandings. A learning program is creative and flexible, a program that generates much of its own motivations and rewards.

It is important to remember that the purpose of the study of arithmetic is to develop quantitative thinking. Algorisms are convenient methods of recording such thinking. If the child's thinking is essentially correct, he may record his thinking in one of several ways. It is the teacher's responsibility to lead the child to a mature and efficient recording of his thinking--not simply to insist that he memorize one specific procedure.

In the appendix, examples are given of levels of thinking showing ways children may record their thinking, ranging from immature counting to high level mental computation.

If further material is needed, it is suggested that the teacher refer to the teacher's manual of the adopted textbooks for ways of adapting material for enrichment for the more able pupils and for reinforcement for the less able pupils. Suggestions for working with the gifted are given in the appendix under a statement by the K-12 Study Committee for the Gifted.

Workbooks to accompany the textbooks may be used in limited numbers as an additional source of material to provide for individual differences.

Suggestions for Homework

Plan lessons to meet individual weaknesses or needs as determined by the teacher; for example, a lesson may use carry facts in multiplication.

Assign work that requires recall of previous skills for a group within a classroom. While working with addition of fractions, a recall lesson in long division could well be assigned.

In problem solving, have children make up several problems involving the topic being studied.

As preparation for a new topic such as percentage, have the children find how the concept, skill, or understanding is used in their daily lives. Newspapers, magazines, and labels of packages on kitchen shelves could be used as sources.

For better understanding of units of measure, the home affords a wealth of practical opportunities.

Size of rooms

Heights of ceilings

Width of the lot (by pacing)

Measurement of ingredients for cooking

Cost of food supply for a week

Cost of a family automobile trip

Homework assignments should be made only after they have been carefully explained and developed with children. Parents should not need to do the teaching.

Textbooks, Practice Exercises and Problems Books, and other printed materials should be sent home as a part of the assignment. Much valuable instruction time is lost by having children copy assignments to be worked at home.

A Plan for Grouping

Administrative grouping within a school should be made to afford the maximum teaching efficiency.

Three main considerations determine the desirability of grouping:

Can the individual achieve better with such grouping?

Can the class standard of achievement be raised by such grouping?

Can the teacher succeed with such grouping?

In addition to the administrative grouping, subgrouping within the classroom is both necessary and desirable for the successful achievement of the objectives of the K-12 Mathematics Program as not all pupils are ready to proceed at the same rate.

At the beginning of every school year the teacher will need to determine each pupil's readiness for new work by carefully checking his present status. The class can then be grouped as follows:

A. Pupils who show that they can proceed with the course of study as it is planned.

This group would include the more able pupils who can carry on enrichment projects along with the regular course of study.

B. Pupils who, for various reasons, need to proceed more slowly.

For this group, abstract computation must be more closely related to concrete experiences. Much planned review and reteaching may have to be done with this group before they are ready to proceed with the regular course of study.

In determining the most advantageous grouping for each pupil, attention should be given to the following sources of information:

Cumulative records

Standardized tests of achievement

Informal teacher-made tests

Diagnostic tests

Inventories

Individual diagnostic tests for the slow, retarded, or weak pupils to determine the exact nature of their difficulties

Observation of a pupil who may be asked to "think out loud" while working a problem.

The extent and kind of directed reteaching and review will be an outgrowth of such an approach.

Generally, for presenting and developing new concepts or materials, all subgroups may profitably be taught as a single group. Pupils learn not only from their teachers but also from one another. In addition, the purpose of a lesson often determines the grouping. A "concept development" lesson, with the pupils actively involved with the teacher, can well be presented to the whole class whereas a "practice-response" lesson should be used for subgroups, as subgrouping allows the teacher to work with fewer pupils and to evaluate better the progress of each individual.

Groups should be flexible in nature, and a regrouping may be desirable after a period of instruction.

To achieve the objectives and philosophy of the mathematics program, teachers should strive to develop in pupils better understandings of mathematical concepts and processes before practice and drill materials are used.

GRADE TWO

Grade 2

In Grade 2 much emphasis is placed on developing an understanding of the nature of our number system. Concepts of relative value, meaning, sequence, and orderly arrangement of numbers are extended through 199.

The understanding of addition and subtraction facts, sums and minuends through 12, will be developed and the facts studied.

Solving problems related to school, home, and the nearby community which involve skills in addition, subtraction, and measurement will be practiced throughout the year so that by the end of Grade 2 the child will have achieved some proficiency in these skills.

Skills using the clock, calendar, and other measurement will be extended beyond those acquired in Grade 1.

Emphasis is placed on the mathematics needed by the child in his world. Acquisition of mechanical skills is considered important, but secondary.

Topics	Objectives, Concepts, and Understandings	References and Activities
Reviewing Rational counting through 49 Rote counting through 99 Reading and writing numbers through 99 Meaning and value of numbers through 49 Vocabulary first, next, last; before-after; left-right; higher-lower; highest-lowest; top-bottom Number names and ordinal names through 10	To recall concepts and understandings gained at earlier levels Identification of quantity by numbers and number names Identification of place or position by ordinal names Counting to determine quantity Ten-ness of our number system	Counting, p. 20 (limit to 99) Number Concepts, p. 23 (limit to 49) Follow manipulative activities with review from printed materials Learning to Use Arithmetic Book 2, pp. 1, 2, 3, 4, 5, 6, 8, 9 Working with Numbers Book 2 p. 17-19
Counting Rational counting through 50 by 1's, 2's, 5's and 10's; money to $1.00 Rote counting through 149 Ordinals through tenth Reading and writing Number names through eleven Numbers through 99 in decades and in isolation Meaning and value Numbers through 99 Vocabulary above-below, top-bottom, over-under, larger-smaller, largest-smallest	To extend the concept of the orderly arrangement of our number system based on a notational system of ten	Counting, p. 20 Number Concepts, p. 23 Follow manipulative development with appropriate exercises from workbooks Learning to Use Arithmetic Book 2, pp. 7, 10, 11, 12, 57, 60, 61, 81-83, and others as needed Meaning and Value of Numbers, Appendix Vocabulary, pp. 34, 45 Working with Numbers Book pp. 29, 30, 31, 32, 41
Addition Reviewing Addition and subtraction facts, sums and minuends through 6, signs: +, -	To recall and master the 28 addition and subtraction facts, sums, and minuends through 6	Table of 100 basic additio and 100 basic subtraction facts, Appendix, pp. A3, A Practice material involvin these 28 facts from printe materials

Grade Two
First Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Processes with Integers	Addition and subtraction facts, sums and minuends 7 through 10, through grouping of objects or money Grouping to discover related facts about numbers Addition 7 is 4 and 3, so 4 + 3 = 7 and 3 + 4 = 7 Subtraction 7 is 4 and 3, so 7 - 4 = 3 and 7 - 3 = 4 Multiplication 8 is 4 and 4, so two 4's are 8 Division Two 4's are 8, so 2 equal parts of 8 are 4 and 4 Related facts 9 is 4 and 5, or 5 and 4, so 4 + 5 = 9, 9 - 5 = 4 5 + 4 = 9 9 - 4 = 5 10 is 5 and 5, so 5 + 5 = 10 10 - 5 = 5 two 5's are 10 and the equal parts of 10 are 5 and 5	To show by manipulation of objects and money the number facts inherent in a number, and to develop the following concepts of the four processes: • putting together to make more (addition) • taking away to have less (subtraction) • combining equal groups to make more (multiplication) • separating to have equal groups (division) To develop the concept of the inter-relatedness of the number facts in the various processes Addition and subtraction (odd numbers) Addition, subtraction, multiplication, and division (even numbers)	Grouping, pp. 27-29 (adapt to numbers 7-10) Follow much manipulative development with many appropriate exercises from printed materials. Learning to Use Arithmetic Book 2, pp. 13, 14, 15, 17, 24, 19-23, 32-38, and other as needed Working with Numbers Book 2 pp.33-38 and others as needed Basic Addition and Subtraction Facts, Appendix pp. A3-A4 Manipulative activities with objects and money Suggestions for Using Strip Counters, Appendix
Ratio, Proportion	Reteaching 1/2 and 1/4 if they occur in meaningful situations	To reinforce the meaning of a unit fraction: 1/2 means 1 of the 2 equal parts of a whole	Fractions, p. 44 Follow manipulative activities with appropriate exercises from printed material

Topics	Objectives, Concepts and Understandings	Reference and Activities
Reviewing Clock Telling time to ½ hour Coins Penny, nickel, dime Other measurements as they occur in classroom situations	To recall knowledge of measuring devices and their uses learned at earlier levels	Measurement, p. 30 The Half-Hour
Extending Calendar Days Weeks Months Coins to one dollar Linear to one yard Liquid to one gallon Dozens, pounds	To extend knowledge of measuring devices and their uses	Measurement, pp. 29-33 Any activities that are listed which fit into class situations Learning to Use Arithmetic Book 2, pp. 27-29, 42, 84 Working with Numbers Book 2, pp. 39-40, and others as needed
Locating and reading material on a number decade chart	To develop an awareness of the function of a chart as a way of recording material for future use To learn to use a chart to gain needed information	Numbers to 99 Use a reference chart to find sequence of numbers; count by 2's, 5's, 10's from any number, 1, 3, 5, 7, etc. 5, 15, 25, 35

	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Grade 2
First Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Mathematical Reasoning	Extending Problem solving involving activities related to clock and other measurements; problems related to school and community Encourage mental solution without use of written computation Use addition and subtraction facts already learned (sums through 10) Extend use of arithmetical terms as shortest, longest	To develop the ability to use arithmetical skills already learned to solve problems	Problem Solving, p. 33, 34 Follow oral problems with appropriate problem-solving exercise Learning to Use Arithmetic, Book 2, pp. 40-46 and other as needed Working with Numbers Book 2 pp. 44, 45 and others as needed
Mathematics in Human Affairs	Problems related to the community	To relate arithmetic to effective participation in community living	Social Studies Unit Our Community

	Topics	Objectives, Concepts, and Understandings	Reference and Activities
	Reviewing Each topic listed in the first 9-weeks' outline before new work in each is introduced	To assure readiness of the pupil for new work	References listed in first 9 weeks outline
Number and Number System	Counting Rational through 50, except money through $1.50 Rote through 199 by 1's, 2's, 5's, by 3's to 30 Reading and writing Numbers from 100-149 in decades and in isolation Meaning and value Numbers 100-149 Number names through twelve Recognition of dollar sign and cents point Roman numerals to V Vocabulary Pair, before, after, next, last, left, right, group, more, fewer, most, fewest, same number as, less	To develop the concept of grouped and ungrouped values of digits To introduce the use of the dollar sign and cents point To introduce Roman numerals as another way of identifying quantity	Counting, p. 20 Number Concepts, p. 23 Notation and Numeration, p. 25 Adapt to fit topics as listed Learning to Use Arithmetic Book 2, pp. 106, 143, 78, 88, 90, 129, 130 Regrouping pp. 21, 22 Meaning and Value of Number Appendix, p. A28-A30 Place Value, Appendix
Processes with Intagers	Addition and Subtraction Development of facts, sums and minuends of 11 Column form Missing number form Equation form 9 + 2 = 11 11 - 9 = 2	To extend the development of addition and subtraction facts through sums and minuends of 11	Addition and Subtraction, pp. 36-40 Adapt to facts of 11 Follow manipulative development with appropriate exercises from printed materials 100 Basic Addition and Subtraction Facts, Appendi pp. A3, A4

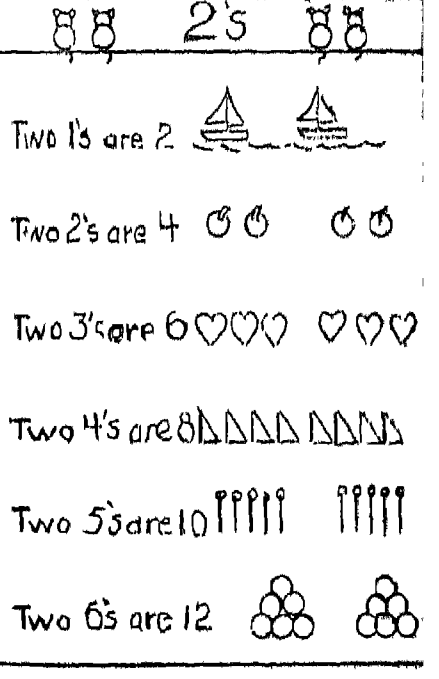
Grade Two
Second Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Processes with Integers	<u>Multiplication and Division</u> Maintain facts of doubles, sums through 10; equal parts of doubles, sums through 10 Relate the doubles to all four processes 3 + 3 = 6 (addition) 6 - 3 = 3 (subtraction) Two 3's are 6 (multiplication) 3 and 3 are equal parts of 6 (division)	To maintain and extend concepts of multiplication and division and of the inter-relatedness of number facts throughout the various processes	<u>Learning to Use Arithmetic</u> Book 2, pp. 43-48, 52, 68, 70-74, and others as needed <u>Working with Numbers</u> Book 2 pp. 46-50 and others as needed
Fractions, Ratio, Proportion	Extending $\frac{1}{2}$ and $\frac{1}{4}$ in meaningful situations	To extend the concept of halves and fourths as being equal parts of a whole	Fractions, p. 44 <u>Learning to Use Arithmetic</u> Book 2, pp. 26, 85
Measurement and Statistics	Time No new work Calendar No new work Coins Equivalents to 25¢ Other measures as needed in actual classroom situations	To maintain knowledge of measuring devices and their uses gained at earlier levels To develop the coin equivalents for 25¢	Measurement, p. 65 A Clock Quiz Quickie A Calendar Quiz Quickie Other Measurements, p. 32 How We Buy Things Measuring Quizzes We Measure Water, p. 33 We Measure Milk Equivalents Chart, p. 40 Follow manipulative development with appropriate exercises from workbook

	Topics	Objectives, Concepts, and Understandings	References and Activities
Functional Relationships	Making a chart for odd and even numbers	To develop an awareness of charts as a means of recording material for future use To learn to locate and read material on a chart	Counting, p. 20 Odd and Even Printed materials
Mathematical Reasoning	Solving problems involving activities related to calendar, money, change making, postage, dozen Using addition and subtraction facts already learned Extending use of vocabulary	To develop ability to apply arithmetical skills already learned to problem solving	Solving Problems, pp. 33, 3[illegible] Follow this work with appropriate problem-solving exercises from workbook Vocabulary, p. [illegible] Evaluation of Arithmetic Vocabulary
Mathematics in Human [illegible]	Problems of communication	To develop understanding of the arithmetical concepts used in the social intercourse of people	Social Studies Unit Communication in Our Everyday Living

Grade Two
Third Nine Weeks

	Topics	Objectives, Concepts, and Understandings	Reference and Activities
	Reviewing Any work of the first semester for which a need is indicated	To maintain knowledge gained at earlier levels and to assure readiness for new work	References listed for first semester work
Number and Number System	Counting Rational through 50, except money through $2.00 Reading and writing numbers through 199 in decades and in isolation Meaning and value of numbers through 199 Number names through twenty Ordinal names Mastery through tenth (use of others beyond if needed) Roman numerals through XII Continued use of dollar sign and cents point	To maintain and extend concepts and understandings of numbers and number system gained at earlier levels	Counting, Number Concepts, Notation and Numeration, pp. 20-26 Learning to Use Arithmetic Book 2, pp. 129-131, 139 and others as needed Working with Numbers Book 2, pp. 53-59 Meaning and Value of Numbers, Appendix
	Vocabulary Add, subtract, take away, column, missing number, addends		Vocabulary, pp. 34-45

Topics	Objectives, Concepts and Understandings	Reference and Activities
Addition and Subtraction		
Reviewing: All number facts, sums and minuends 7-11	To work toward mastery of number facts sums and minuends 7-11	Chart of 100 basic addition and 100 basic subtraction facts, Appendix, pp. A3, A4
Mastery of the 28 addition and 28 subtraction facts, sums and minuends through 6	Master the 28 addition and 28 subtraction facts, sums and minuends 1-6	
Developing the addition and subtraction facts of 12 Column form Missing number form Equation form	To extend the development of number facts through the sums and minuends of 12	Addition and Subtraction, pp. 36-40, Appendix, pp. A3, A4 Learning to Use Arithmetic Book 2, pp. 109-112, 123, 126, 114-117, 113-116, 118, 127
Introducing Concept of subtraction to find how may more, how many less, difference	To develop a broader concept of the meaning of subtraction	
Multiplication and Division		Working with Numbers Book 2, pp. 73-75, 78-83
Doubles for addition facts of 12, 6 + 6, to be read Two 6's are 12 The 2 equal parts of 12 are 6 and 6	To reinforce the concept of equal groups as readiness for multiplication and division 1. Combining equal groups 2. Separating equal groups	

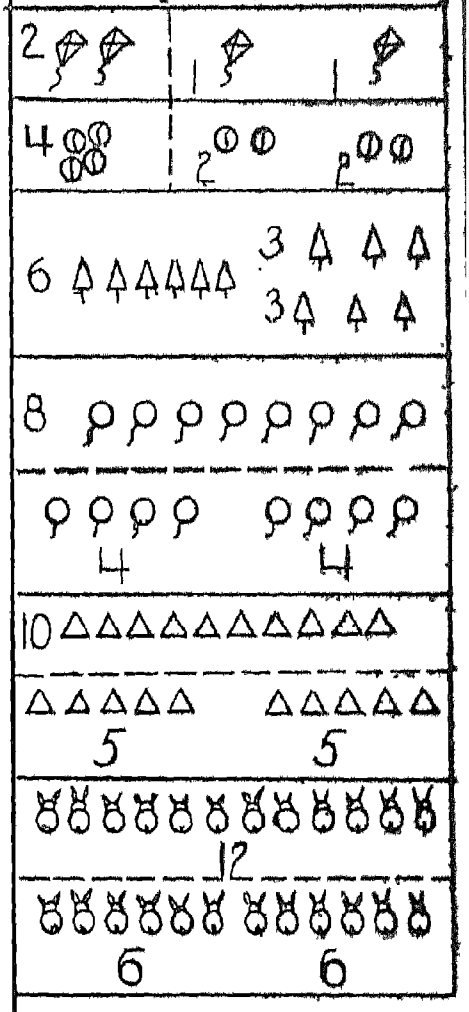
Grade Two
Third Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Fractions, Ratio, and Proportion	Extending 1/2, 1/4, 1/3 through meaningful situations as they occur in classroom activities	To maintain and extend the concept of 1/2, 1/4, 1/3 as being one of the 2, 4, or 3 equal parts of a whole	Fractions, p. 44 Measurement, p. 33 We Measure Ribbon Learning to Use Arithmetic, Book 2, pp. 85, 90, 128, 14 Working with Numbers, Book 1 p. 77
Measurement and Statistics	Extending measurements Clock Telling time to quarter hour Money Change to 25¢ Calendar No new work Extend study of the year Inches, feet Other measurements as needed	To extend concepts of units of measurement	Measurement Learning Quarter Hours, p. 96 Making Change, p. 41 What Coins Shall We Use? How Many Ways to Pay, p. 4 The Months of the Year, p. 42 Activities for using ruler and yardstick under Suggestive Activities, p. 4 Inches and Feet, p. 43 Appropriate exercises from workbook
Graphs and Functional Relationships	Using charts as reference material	To extend awareness that charting material is a way of organizing and keeping information and of showing comparisons	Develop and use a "doubles" chart as described under th topic multiplication Number Concepts, p. 23 Comparing Charts Progress records, Learning to Use Arithmetic Book 2, Guide, pp. 145

	Topics	Objectives, Concepts, and Understandings	References and Activities
Mathematical Reasoning	Problems involving activities related to money, weight, change making, writing money, equal groups, doubles, addition, and subtraction facts	To develop skill in using arithmetical facts and techniques in problem solving	Problem Solving, p. 44
	Extend use of arithmetical terms		Vocabulary, p. 45 Also appropriate problem-solving and vocabulary exercises from printed materials
Mathematics in Human Affairs	Problems related to our immediate world	To develop awareness that arithmetic is in everything we do	Social Studies Unit The World Through Our Five Senses

Grade Two
Fourth Nine Weeks

Topics	Objectives, Concepts, and Understandings	References and Activities
Maintaining thorough practice Rational counting to 49, except money to $2.00 Rote counting, meaning, and value, reading and writing of numbers to 99 Number words one through twenty Ordinals first through tenth Roman numerals to XII Vocabulary as needed in daily activities No new work	To maintain through meaningful practice the understanding of numbers and number systems gained at earlier levels	Counting, p. 20 Number Concepts, p. 23 Notation and Numeration, pp. 25-26 Learning to Use Arithmetic Book 2, pp. 78-80, 129, 130 Working with Numbers Book 2, pp. 85-90
Addition and Subtraction Reviewing all number facts, sums, and minuends 7 through 12 Mastery of all number facts, sums, and minuends 1 through 5	To work toward mastery of all number facts, sums, and minuends 7 through 12 To master all number facts, sums, and minuends 1 through 6	Addition and Subtraction of Integers, pp. 36-41 Racing Circle Number Bee Secret Code Ladder Game
Addition examples 3 addends sums 12, or less 2 3 4 5 4 5 4 1 5 2 3 3 Adding and subtracting tens 20 30 40 50 +10 +20 -20 -10		Addition and Subtraction of Integers, pp. 36-41 Adapt Quiz Quickie to 3 addends, sums 12 or less

Topics	Objectives, Concepts, and Understandings	References and Activities
Adding and subtracting other 2-place numbers 21 43 36 48 +36 +25 -24 -48 Extending development of addition and subtraction facts to facts of 13, 14, 15 if pupil readiness and maturity for them is unquestionable		Use appropriate exercises from workbook
<u>Multiplication and Division</u> Maintaining concepts of equal groups Combine equal groups to make more Separate a group into equal groups to find its equal parts 6 + 6 = 12 Two 6's are 12 12 is two groups of 6 Developing a chart showing equal parts of numbers	To maintain concept of combining equal groups in readiness for multiplication To maintain concept of separating a group into its two equal parts in readiness for division	Equal Parts 

Grade Two
Fourth Nine Weeks

Topics	Objectives, Concepts and Understandings	References and Activities
Reviewing 1/2, 1/4, 1/3 No new work	To maintain the concept of a unit fraction as one of the equal parts of a whole	Use appropriate exercises from workbook
Extending Money Making change for 25¢ Coin equivalents for 25¢ Calendar Seasons Months in each season Other measurements as needed	To extend concepts of units of measurement and their uses	Measurement, pp. 41-43 How Much in All Learning the Seasons with Jimmy and Timmy A May Diary A Visit from the Milkman Use of appropriate exercises from printed materials Working with Numbers Book 2, p. 91 Learning to Use Arithmetic Book 2, pp. 80, 83, 132, 107, 125, 134, 119-121
Finding and interpreting information from a chart	To extend awareness of charts as a means of organizing information and keeping it for future reference	Use a chart showing equal parts such as that described under the topic Division p. 1 as a reference chart for needed information Measurement, p. 30 A Daily Time Schedule

Topics	Objectives, Concepts, and Understandings	References and Activities
Solving problems involving activities related to calendar, season; liquid measurement to gallons; foot, inch ruler, yardstick; pounds Use addition and subtraction facts, doubles, and equal parts	To develop skill in using arithmetical facts and techniques	Measurement, pp. 42-44 Inches and Feet Other Measurements Calendar Problems 2A Arithmetic Test, pp. 45-47 Use appropriate exercises from workbook
Problems Relate to the world around us	To develop awareness of the prevailing influence of arithmetic in everything we do	Social Studies Unit Water

Second grade children have come to some understanding of the need for numbers in the day's activities. It now becomes desirable to keep them aware of this need and to further their skill in meeting it. The following outline suggests some ways of doing this. It is offered as a possibility and not as a prescribed pattern for a day's activities.

DAILY ACTIVITIES	ARITHMETIC UNDERSTANDINGS
Orientation	
Reading calendar	Number sequence
Computing attendance	Subtraction (29 children belong 4 are absent — 25 are present)
Counting money collected for lunch and milk	Value of coins (8 dimes are 80c . . . 5 nickels are 25c)
Recording money collected	How to write amounts of money
Making new daily schedule	How to read and write hours and minutes The division of a day Meaning of a. m. Meaning of p. m. Meaning of *half* a day (A school morning is not a full *half* day)
Reading	
Comparing children's library book achievements	Addition (24 pages John has read 22 pages Mary has read — 46 pages both have read)
Spelling	
Preparing paper and numbering	Value of numbers (2 tens are 20; 2 rows of 10) Fractions (Folding a paper in *half*) Vocabulary column (Writing words in *column*)
Art	
Arranging groups for work	Fractions Thirds, 1/3 (Divide the class into thirds. Each group gets 1/3 of the paper.)
Social Studies	
Opening the play store; discussing how to use the various items in the store	Use of measuring tools Ruler, yardstick, scales Units of measure Yards, pounds, dozen Fractional parts of measures *Half*-pound, *half*-dozen, *fourth*-pound
Physical Education	
Discussing outside temperature	How to read the thermometer Comparisons of temperature (Was the 40° of yesterday warmer or colder than the 48° of yesterday?) How to record the present temperature on a play thermometer (Does the red line need to be moved up or down today?)

Objective: To extend skill in counting to 149.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply counting concepts learned in 1A to 2B situations.

Extend counting to 150 by ones, twos, fives, and tens.

Use correct language form on all occasions. Avoid the use of *and*. Say "One hundred, one hundred one, one hundred two."

Develop a working plan to give speed and accuracy in seatwork.

Recall method of counting coins in which fingers are used to "draw out" and count coins.

Suggest a similar system for sorting numbered counters, which would make seat practice easier and faster.

Demonstrate the system with envelope of squares numbered from 1 to 100.

"Brush" squares out on desk gently with hand. Using fore-finger as in coin counting, draw out all the single numbers (1 through 9) and lay them to left. Now draw out the two-place numbers beginning with 1 (10 through 19) and lay to the right of the single numbers. Now, draw out two-place numbers beginning with 20, 30, 40, 50, 60, 70, 80, and 90 in order. Arrange each decade in serial order so that they form a chart.

Let the children try this system of sorting numbered cards. (Supervised seatwork.)

Provide enough practice to establish a working habit that will help the child gain speed and accuracy.

Have children practice the same system with numbers 100 to 150 after number chart has been developed. (See Meaning of Numbers in *Number Concepts*.)

Use same system for odd and even numbers, (See "Odd and Even.")

Counting Coins

The 2B's find this system of counting coins easy to use:

Counting pennies by twos

"Place the forefinger and second finger each on a coin and draw coins toward you as you count by twos."

Counting nickels by fives

"Place the forefinger on coin and draw coin toward you as you count by fives."

Counting dimes by tens

"Place the forefinger on coin and draw coin toward you as you count by tens."

Odds and Even

1	11	21	31	41	51	61	71	81	91	Yellow
2	12	22	32	42	52	62	72	82	92	Red
9	19	29	39	49	59	69	79	89	99	Yellow
10	20	30	40	50	60	70	80	90	100	Red

In these sets of numbered squares that the children are given, odd numbers are on yellow paper, even numbers on red. Each child arranges his set in a "chart" before him. He can then be led to observe these interesting facts:

1. There is a row of odds, a row of evens, a row of odds, and so on.
2. The red numbers (or even numbers) are just like the "twos" chart.
3. The even-numbered squares (red) can be taken out to build an "evens" chart.
4. The odd-numbered squares (yellow) that are left after even-numbered squares are taken out make an "odds" chart.
5. Everything about our number system is orderly.

Suggestive Activities

Develop the understanding of grouping and regrouping based on the notational system of tens to

Extend the understanding of place value

Prepare for regrouping of addition and subtraction (commonly referred to as carrying and borrowing)

Plan to have situations arise that require changing ones to tens and tens to one, involving money such as

Quarter or half dollars exchanged for dimes, pennies

Dimes changed for pennies
Pennies changed for dimes

Show a quarter in these ways

	Dimes	Pennies
1	2	5
2		25
3	1	15

Show 10¢ as

	Dimes	Pennies
1	1	
2		10

How Some Teachers Do It

We Learn About Regrouping

During the Junior Red Cross Drive, many of the children in Miss Clark's room brought money to put into the Red Cross box. Bobby had a problem. He had brought a quarter but all of it was not for the Red Cross. 10¢ was for Red Cross, 8¢ was for bus fare, and 7¢ was for Bobby to spend. It was clear that Bobby's quarter must be broken into parts.

There were many responses to Miss Clark's call for change for Bobby's quarter. One child offered 25 pennies; another 2 dimes and a nickel; and another 15 pennies and a dime. These offers provided Miss Clark with sufficient representative material to present grouping and regrouping of tens and ones and for showing why this technique is good to know.

After the activities described under Suggestive Activities had been carried out, the class decided that for Bobby's purpose either 25 pennies or 1 dime and 15 pennies would be needed.

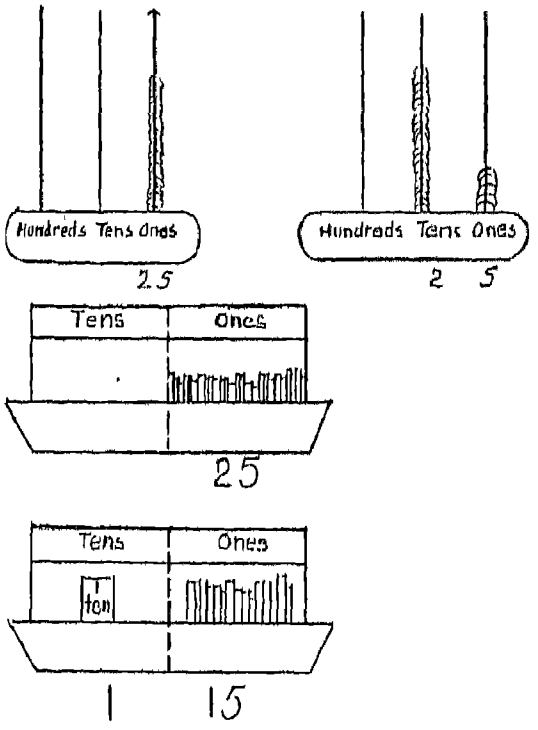
.....

The following day Miss Clark showed special interest in the dimes and pennies that were brought. She had the pupils arrange all the pennies in stacks of 10 and all the dimes in a stack. She told the class that her small nephew often wanted to change pennies for dimes because his dime bank did not take pennies. With the dimes and pennies, Miss Clark let the children discover the regroupings possible with various amounts of pennies.

50 pennies - 5 dimes
35 pennies - 3 dimes 5 pennies
2 dimes 15 pennies
1 dime 25 pennies

Suggestive Activities

Show 25 on abacus and pocket chart, then chart the findings



Use other 2-place numbers in the same way

Learn to think regrouping (without objects) writing out place values

25 is 2 tens and 5 ones
25 is 1 ten and 15 ones
25 is 25 ones

Learn to think regroupings and state place value without writing

Name this technique, regrouping

Practice regrouping dollars, dimes, and cents as readiness for regrouping of hundreds, tens, ones

How Some Teachers Do It

Tens and Ones

Miss Clark used an opened abacus and carem rings to show grouping and regrouping of numbers In still another lesson, counters and the pocket chart were used. To be consistent with the idea of a dime as 1 ten, Miss Clark used counters that were given a value of 1.

> Ten one-counters stacked or bundled together are exchanged for one tens-counter, just as a stack of ten pennies is exchanged for a dime. Miss Clark has found that the step of actually exchanging ten ones for 1-ten makes the idea of regrouping on the basis of ten more meaningful. She substituted tens and ones in the heading dimes and pennies.

Dollars, Dimes, Pennies

The $1.65 milk lunch money brought in on Friday gave Miss Clark the opportunity to develop the concept of regrouping in three places as readiness for regrouping of hundreds, tens, and ones when they are needed in addition and subtraction in third grade.

	Dollars	Dimes	Pennies
$1.65	1	6	5
$1.65		16	5
$1.65		10	165
$1.65		10	65

Objective: To extend the concept of number value to 149.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Relationship of numbers in sequence

Apply concepts learned in 1A to 2B situations.

Develop the serial order of numbers from 100 through 149. Develop meaning of numbers at the same time.

Arrange numbers above 100 on a sequence chart.

Give practice to make sure the relationship between the numbers 10 to 149 and the numbers 1 to 49 is understood.

Have children complete duplicated number chart.

Emphasize again the relationship between the numbers 100 to 149 and the numbers 1 to 49.

Have children tell what number comes just before and just after these numbers: 13, 113; 16, 116; 34, 134; 56, 156. (See "Comparing Charts.")

Meaning of numbers

Apply concepts learned in 1A to 2B situations.

Help children to discover that 100 is 10 tens.

Have children recall the meaning of numbers 90 through 99; manipulate counters to show that 100 is 10 tens; and count pennies in stacks of ten to show that 100 is 10 tens.

Help children to discover that a hundreds number is *always* a three-place number.

Demonstrate hundreds place with the 125 pennies counted in the Red Cross fund. (See "Our Red Cross Fund.")

(Since the concept of place value at earlier levels developed from ones to tens, begin in that order to show the development of the hundreds place.)

Demonstrate other numbers of three-place value. (Avoid zero for the time being.)

133 (pennies in milk fund)
145 (counters in one box)
132 (locker number)

Demonstrate zero as a place holder. (See "Zeros Are Nothing at All.")

Build a number chart by columns as meanings of numbers are developed. Continue to add numbers column by column as meanings are developed to 149.

Provide practice with manipulative materials.

Use cardboard strips and envelopes of numbered squares to give manipulative practice as an approach to written forms.

Give blackboard assignments: "Show the hundreds, tens, and ones in 112, 125, 134, 144."

Hundreds	Tens	Ones
1	1	2
1	3	4
1	0	5
1	4	0
	5	9
		6

Have I Any Mail?

"Have I Any Mail?" is a favorite game with Miss Steven's 2B group. One child is the "postmaster," a pocket chart is the "post office," and the numbered flash cards are "mail."

The children in turn call for their mail.

Child: "Have I any mail today?"
Postmaster: "What is your name?"
Child: "My name is one hundred one."
Postmaster: "Oh, yes. You have three letters —one hundred, one hundred one, one hundred two."

There must always be three "letters"—the number named, the number before, and the number after. If the postmaster gives the wrong mail, he is out. If the "customer" accepts the wrong mail, he gets no score. The score is determined by the number of cards each child holds at the end of the game.

Comparing Charts

Two charts are needed for this activity: one for numbers 1 to 49, the other for numbers 100 to 149.

The teacher says: "Find 12. Find the number just before it. Find the number just after it. Now on the other chart find 112. Find the number just before it and the number just after it."

The teacher records the numbers on the board as the children find them.

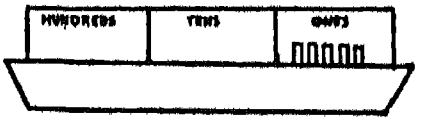
The teacher should give enough practice to establish an idea of relationship between two- and three-place numbers.

Our Red Cross Fund

One hundred twenty-five pennies looked like a lot of money to the 2B's in Miss Howard's room. There it stood in neat stacks of ten just as they had counted it—twelve stacks of ten pennies each and five pennies left over. Miss Howard declared she was so proud of it that she wished everyone could see it. But she couldn't leave all that money on the desk! She suggested that they put bundles of colored sticks in the pocket chart to show the number of pennies in their Red Cross fund.

The children soon counted twelve bundles of ten sticks, one for each stack of pennies. They counted out five single sticks, too, for the pennies left over. Miss Howard cleared the pocket chart. It was easy to start with the ones and tens, for the children knew exactly where to put them.

They put the 5 ones in the right-hand pocket.



They wrote the 5 on the board (5).

They knew what to do with the twenty (2 tens), too, for they had built all their decades through 99. They added the twenty in the tens place and recorded it by the 5 (25).

The ten bundles left created a *new problem.* They counted them and made sure of 100. They decided they needed another place for the hundreds, and since they had moved from left to right in the first steps, it seemed logical to continue so.

They added the hundred and recorded it by the 25 (125).

To be sure that they understood what each number meant they said:

"1 is for 10 tens –one hundred"

"2 is for the 2 tens--twenty"

"5 is for the 5 ones--five"

"One hundred twenty-five"

Zeros Are Nothing at All

Zeros are nothing at all when the teacher prepares for their presentation as Miss Howard did.

ress zero as a place holder.

On the morning when Miss Howard presented the zero as a place holder she had these materials ready:

Pocket chart

Strip of chart paper (3"x12")

Colored sticks in packages of 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110

Eleven cards with zero on them

Eleven cards with the number 1 on them

Eight cards numbered as follows: 2, 3, 4, 5, 6, 7, 8, 9

The pocket chart was divided into places by narrow ribbons of red paper.

The children counted their sticks into bundles of tens. One child counted exactly 100 sticks. The others had singles left over. The following conversation occurred between Miss Howard and the child with 100 sticks.

"Have you any ones to put in the ones' place?"
"No."

"Is there a card on the board ledge that will tell that you have no ones?"

"Yes, this one." (Child points to zero card.)

"Put the zero card *under* the place for the ones. How many tens have you?"

"Ten."

"Put them all together. How many sticks are in your pile now?"

"Ten tens are 100. There are 100 sticks."

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

"Have you any extra tens for the tens' place?"

"No."

"Put the zero card *under* the place for the tens. Now where will you put your 1 hundred sticks?"

"In the hundreds' place."

"What card will you place under it to show there are 100 sticks there?"

"This one." (Child points to card with number 1 on it.)

(To the class) "When we have no ones or no tens, what do we put in their place?"

"Zero."

"Let's write the number we have in the chart on our strip of paper."

In the same way Miss Howard helped each child in turn place his sticks and cards in the pocket chart.

Value of numbers

Apply concepts learned in 1A to 2B situations.

Extend activities to include numbers through 149.

Help children compare length of books. ("Which has more pages to read?")

Help children compare two or more groups of pennies stacked by tens. ("Which has more? Count by tens to check.")

Remind children that smaller numbers occur first in the arrangement of numbers in our counting system. ("Write the smallest of these numbers: 116, 114, 112.")

(see "Using Our Work Sheets").

Using Our Work Sheets

When Miss Wright assigns a work sheet to her 2B's it is more than just an incident in the day's routine. The very nature of her assignment implies such importance that the children feel a responsibility to do the exercise carefully and well.

The exercise sheet assigned for today is page 17. The children and Miss Wright examine the sheet together and decide what is wanted. "We are to find the largest number in each group and write it on our writing paper."

They decide that if they need help they can use their number chart, which hangs on the wall (see Meaning of Numbers, p. 54).

They discuss the heading they will need on their papers. "We should put our name, the date, and Arithmetic on our papers."

When no one has further questions, it is apparent that the class is ready to begin their unsupervised seatwork.

Objective: To extend the reading and writing of Arabic numbers to 149 and Roman numerals to XII.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Reading of numbers

Apply concepts learned in 1A to 2B situations.

Extend the reading of numbers from 100 through 149.

Use correct language form.

Have children read numbers from chart which shows the serial order from 100 to 149.

Emphasize the reading of numbers in any natural situation (page numbers, locker numbers, room numbers).

Roman Numerals

Clocks with Roman numerals on them are not always available in the classroom. However, the teacher can always make a clock face numbered with Roman numerals.

Miss Newell presents first the Roman numerals, I, II, III because the children are already familiar with 1, 11, 111. Then she presents the Roman numeral V since it is the foundation for IV, VI, VII, and VIII.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Find occasion for reading words for numbers through fifteen.

Provide experience in reading numbers representing money.

Teach children what the decimal does:

"It keeps the dollars on the left side and the cents on the right side."

L R
$1.29

Have children practice reading money whenever recording sums.

Teach children to read Roman numerals to XII. (See "Roman Numerals,")

Have children read Roman numerals on real or imitation clocks.

Help them to discover the use of Roman numerals in books.

She says, "V is another way of writing five. If I put a one and a five together, what will I have?"

"Six."

Miss Newell continues. "So if I put V and I together, I will have the Roman numeral VI. Can anyone think how we would make seven?"

"Put one more I on."

"Yes, because five and one are six and one more are seven. To make the Roman numeral VIII we add one more I. Now what number comes just before five?"

"Four."

"To make the Roman numerals VI, VII, and VIII," Miss Newell continues, "we added I's to the Roman numeral V. To make four we start with V, but we won't *add* any ones. What will we do to make four out of five?"

"Take one away."

"Yes, and to show that we are taking one away we put the I before the V."

Then Miss Newell presents X and develops XI, XII, XIII, and IX in the same way she developed VI, VII, VIII, and IV.

Of course several lessons are required to present this material. Many more follow-up lessons in reading and writing Roman numerals and matching them with cardinal numbers are required to fix them as a permanent part of the child's arithmetical knowledge.

Writing of numbers

Apply concepts learned in 1A to 2B situations.

Make the correct writing of numbers coincident with all phases of number recording.

Have children practice writing numbers from 100 to 149 in decades.

Have children write numbers in isolation (street address, phone number, numbers from dictation).

Have children match numbers and words for numbers through fifteen (See "A New Number Chart for 1A").

Have children match numbers, cardinal names, and ordinal names one through ten.

1	*one*	*first*

Have children write Roman numerals and equivalent Arabic numbers.

Write It, Please

Miss Gale's 2B children like to write numbers. They like to hear her say, "What neat straight rows!" or "I like the way your figures are made."

They write numbers frequently just for writing practice and for practice in following directions.

The directions given here are an example of the type of directions Miss Gale gives.

"Write the numbers from 101 to 110 in a straight line with the ones under each other."

"Write 21. Write 121 under it."

"Write the number that comes before 101."

"Write the number that comes before 122."

"Write the number that comes between 114 and 116."

"Write the numbers by tens from 100 to 150."

"Write the numbers by twos from 100 to 110."

"Write the numbers by fives from 100 to 125."

"Write the Roman numerals that stand for 1, 5, and 10."

Objective: To extend group meanings through 15.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply grouping concepts learned in 1A to 2B situations.

Extend group meanings through 15.

Have pupils count groups of children in order to find how many chairs, books, or supplies are needed.

Have children compare groups to find which is larger, which is smaller, which has more, which has most.

Teach children to separate groups and help them to see smaller groups within larger groups.

Use concrete materials.

Have children arrange groups of eleven, twelve, thirteen, fourteen, and fifteen objects in various groupings.

Use cards with figures in group patterns.

Show "teen" numbers as ten and more:

"Eleven is ten and one more."

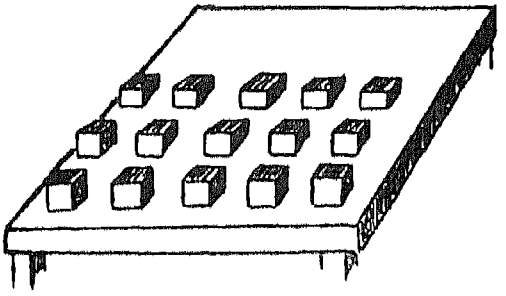
"Fifteen is ten and five more."

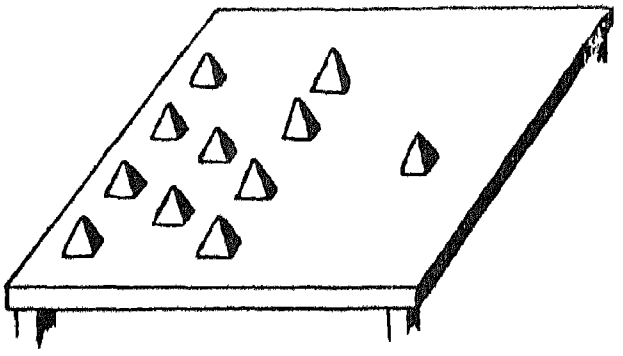
Ten and More Are "Teen"

Although the children in 2B are very familiar with the idea of groups and grouping, there is a new learning step involved in groups above ten. They have to learn the significance of "teen."

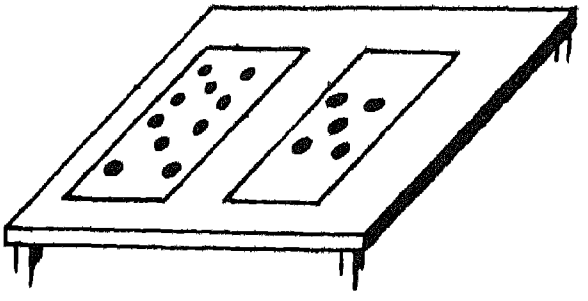
When Mrs. Matt presents groups above ten, she goes back over the steps used at earlier levels; counting, comparing, separating, grouping, and recording. She begins with children and then uses concrete objects and semiconcrete objects.

Concrete objects are arranged in groups of 11 to 15 on children's own desks. Many arrangements, of course, are possible.





Semiconcrete materials, such as cards with figures in group patterns, are used to show teen numbers.



The numbers represented are then recorded on the chalk board as so many tens and so many ones.

Objective: To extend understanding of the addition concept.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply addition concepts learned in 1A to 2B situations.

Extend addition concepts and grouping concepts at the same time.

Use quantitative experiences with concrete materials as a source of number records of groups of 11-15.

Move from concrete manipulation as a source of number records to a level of description.

Adding is "putting together."

```
oooo        oo
oooo
oooo
```

Twelve balls and two balls are fourteen balls.

Adding is "thinking together." Mary has 12 jacks. Jane has 2 jacks. How many jacks do Mary and Jane have all together? (See "Thinking Together.")

Make similar exercise sheets for additional practice.

"Thinking Together"

The idea of "thinking things together" is so much fun that the 2B's in Miss Joy's room "think together" all kinds of things, such as toys, pets, money, and food. Miss Joy shows them how they can keep track of their thinking with figures alone, without using counters or objects.

> Joe and Lyle had 1 rabbit. Lyle brought 3 more rabbits. How many did they have then?
>
> How many rabbits did the boys have at first? 1
>
> How many more rabbits did Lyle bring? 3
>
> How many are 1 rabbit and 3 rabbits? 4
>
> One and three are four. The boys had four rabbits.

Miss Joy wants the children to understand that only like animals or objects may be added. So sometimes they consider stories about like and unlike things and the "trick" is to find what things are to be "thought together."

> Billy gave 2 apples to 2 goats. Then 4 more goats came running to get apples. How many goats were eating apples then?

When the children decide it is goats and not apples that are to be "thought together," they proceed to solve the problem in the same way they solved the problem [illegible].

Miss Joy wants the children to understand that different animals may be "thought together." She gives this problem as an example.

> Four rabbits and 1 baby calf are in the barnyard. How many *animals* are there in the barnyard?

She explains: "We can 'think four rabbits and one calf together' as five animals. In the same way we can 'think boys and girls together' to find how many children."

Objective: To extend understanding of the subtraction concept.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply subtraction concepts learned in 1A to 2B situations.

Extend subtraction concepts concomitantly with grouping concepts. (See *Grouping*).

Use quantitative experiences with concrete materials as a source of number records for groups of 11 to 15. (See *Grouping*).

Move from concrete manipulation as a source of number records to a level of description.

Subtraction is "taking away."

```
oooooo          ooooo
       — oo =
oooooo          ooooo
```

Twelve balls take away two balls leaves ten balls.

"Thinking Away"

The 2B's discover that it is as easy to "think things away" as it is to "think them together." They will find this "thinking" habit very helpful when they meet formal addition and subtraction processes in 2A.

Bobby has a real "think away" story that he tells the class:

> "I had 4 wheels on my wagon. Last night 1 wheel came off. How many wheels are on my wagon now?"

They have the answer so quickly that they don't even have to write it down. But the next one is more difficult, and they put the figures on the board as a record of their thinking.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Subtraction is "thinking away."

Jim's mother gave him 6 big cookies for the school party. He ate 2 cookies on the way to school.

How many has he left? (See "Thinking Away.")

Betty and Bill made 6 mountains in the sand box. Bill's puppy knocked down 2 mountains. How many were left?

How many mountains did Betty and Bill make? 6

How many mountains did the puppy knock down? 2

How many mountains were left standing? 4

Six take away two are four. Four mountains were standing.

By this time the children know they can "put together" or "take away" only like things. So they always look for the like things in their stories first. They look carefully at the word which follows "how many" because that word usually tells *what* their answer will be. The figure tells *how much*.

Objective: To extend knowledge of measuring devices and their use.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Coins

Apply measuring concepts learned in 1A to 2B situations.

Extend the understanding of the value and the equivalents of coins.

Ask children to examine coins for actual words on them.

Have children discuss other common names for each coin:

one cent	—penny
five-cent piece	—nickel
ten-cent piece	—dime
twenty-five-cent piece	—quarter
fifty-cent piece	—half dollar

Give children many experiences with coins.

Have children make a chart with coins, using cardboard and scotch tape. Have them label each coin.

Have children make a chart of equivalents for 15c.

Have children make change for 15c. (See "Storekeeper.")

Have children sort and identify coins. (See "Making Dollars.")

Give practice in thinking of the relative value of coins and their buying power.

Discuss prices of articles listed at the sales counter.

"Which will take more of your 15c—a ball marked 5c or a doll marked 10c?"

Discuss prices of foods and other items listed in the daily paper and money needed to buy them.

Prepare brief oral drills and require a quick response (See "A Quiz Quickie.")

Making Dollars

The day the milk money for the week is collected is a good time to see just what may make a dollar. When the money is all collected, the first step is to sort and identify the coins in a systematic way:

All the pennies in stacks of tens (and "odds" left over in lesser stacks of five, two, one)

All the nickels in stacks of tens

All the dimes in stacks of tens

All the quarters in stacks of fours

All the half dollars in stacks of twos

Dollars or dollar bills together

The second step is to regroup stacks into piles that will make a dollar:

10 stacks of pennies
2 stacks of nickels
1 stack of dimes
1 stack of quarters
1 stack of half dollars

Even though the children do not (and need not) remember all the equivalents involved in this coin activity, they do become aware that change for dollars and half dollars is made with a variety of coins. The coins may at times be mixed: five stacks of ten cents each and five dimes.

Storekeeper

A "sale counter" takes the place of a store in one 2B room. It takes less space, involves less social activity, and thus lends itself well to frequent brief periods for practice in making change. An article and price list hangs behind the counter to show what can be "bought" and for how much. "Customers" use play money, but the "storekeeper" counts change just like a real store-

Clocks

Apply concepts learned in 1A to 2B situations.

Teach children to tell time by the half hour.

Recall these facts:

In one hour the minute hand moves all the way around the face of the clock.

At the same time, the hour hand moves to the next hour number.

Use an alarm clock to show the journey the hands of the clock make in an hour.

Show that just half this journey takes place in a half hour. (See "The Half Hour.")

Teach children to read the time by the half hour.

Teach children to write the time by the half hour.

Use sheets with duplicated clock faces on them for practice in reading and writing time.

Let children make clock faces on paper plates. Have them set hands at hours and half hours.

Calendar

Apply concepts learned in 1A to 2B situations.

Recall and extend the uses of the calendar.

Continue daily work with calendar. Have children do the following:

Find current date on calendar

Record date on the board (May 15, 1951)

Find current day of school week

Tell position of current day as *first, second,* and so on

Distinguish between position of current day in the school week (5 days) and regular week (7 days)

Make individual calendars for use at children's desks

Observe number of weeks in current month

Observe months of the year

Count number of months in a year on a yearly calendar

Count school months

Count months of summer vacation

Call attention to each school month as it occurs, stressing:

The name of the month

The general trend of weather (cold, warm)

The month *before* and *after* current month

Provide exercises similar to "A Calendar Quiz Quickie."

keeper. Susie buys a toy airplane for eleven cents. She gives the storekeeper fifteen cents. He says, "Eleven cents, twelve, thirteen, fourteen, fifteen," as he gives her four pennies in change. He had learned how to "count on" in 1A.

A Quiz Quickie

Is a nickel more than a dime?

Will a dime buy more than a quarter?

Will a dime buy more than a nickel?

Which would you rather have:

A nickel or a dime?

A quarter or a nickel?

Two dimes or a quarter?

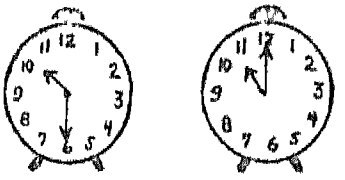
Two nickels or a dime?

Ten pennies or a quarter?

Fifteen pennies or a dime?

The Half Hour

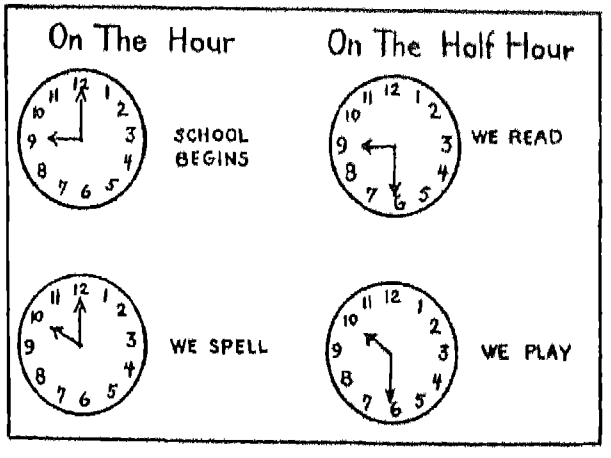
A real clock, even though it's just an old alarm clock, serves best for showing what happens on the face of the clock in a half hour.



By turning the hands the children will see that while the minute hand goes half way around the face, the hour hand goes half way to the next hour number. Children should have the experience of turning the hands themselves, saying as they turn them: "Half hour, hour, half hour, hour."

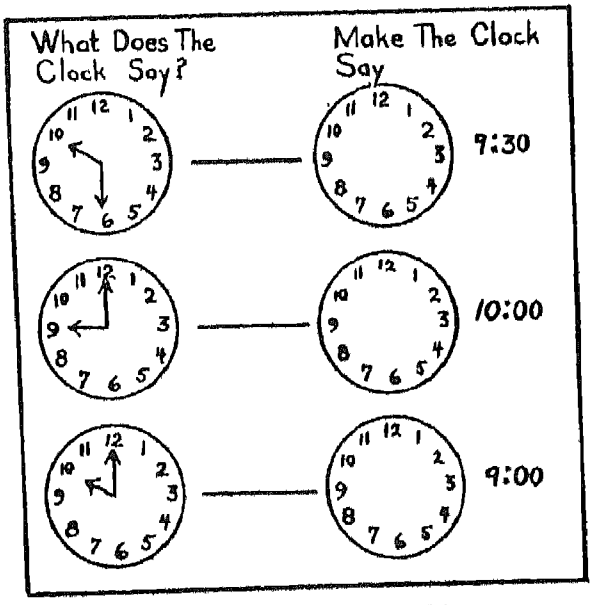
A Daily Time Schedule

Associating events of the child's day with the clock makes telling time meaningful to the child. Miss Virgil and her 2B's make a daily time schedule like this:



They learn to check the clock on the chart with their real clock and to say: "It is 10:30. We may play now."

A Clock Quiz Quickie



A Calendar Quiz Quickie

What day is today?
What day was yesterday?
What day will tomorrow be?
How many days are there in one week?
Name the school days in the week.
Name the first school day of the week.
Name the first day of the regular week.
Name the last day of the regular week.
Name the last day of the school week.
What is the day before Monday?
What is the day after Wednesday?
What will the day after tomorrow be?
Read the dates on which all the Tuesdays fall.
How many Sundays are in this month?

How Long Is a Year?

"How long is a year?" Johnny asked that question at a very opportune time because Miss Giles had just brought a calendar of the year and mounted it on a chart stand.

"Let's find out, Johnny," she said. "You know how long a month is. This calendar will tell you how many months are in a year."

As Miss Giles turned the pages and read the names of the months, Johnny counted them. "Twelve months," he announced.

Miss Giles told the children she would leave the calendar in the room because they might want to refer to it from time to time for information. They did, too! They checked to find how many months there were until Christmas, which months were longest, which months were shortest, which months come after vacation starts, and the like.

Other Measurements

Have children recall what they know about measuring tools and their use. Make a list like the one below:

Measuring Tools We Have Used	*What We Measured*
Clock	Hours and half hours
Calendar	Weeks and months
Thermometer	Temperature
Quart and pint bottles	Milk, water, other liquids
Gallon jar	Snow, paste
Yardstick, foot rule, tape measure	Bulletin board, cloth, ribbon
Coins	Money
Spoons	Ingredients for cookies
Cartons	Eggs
Scales	Children, food in play store

Extend children's knowledge of how measuring tools help us in our daily living.

Discuss how food and other articles we buy are measured.

Make an experience chart showing children's progress in ability to use measuring tools.

Check for general understanding of use of measuring tools. (See "Measuring Quizzes.")

They found a yearly calendar in the room very convenient. The calendar committee used it each month when they helped Miss Giles make the new calendar.

How We Buy Things

One day early in September Tommy told the class that his mother had bought a bushel of peaches to can.

"Can you tell the class about how much a bushel is?" asked Miss Burns.

Tommy tried. Some of the other children already knew because their mothers were canning, too, and had bought bushels of tomatoes, apricots, and other fruits. Bill's mother had bought a 10-pound sack of sugar. The children agreed that it would be fun to show on a chart the food, materials, and other items their mothers buy for the family that need to be measured. Betty mentioned her big hair bow which was made out of a yard of ribbon. Nearly everyone said his mother buys eggs by the dozen and milk by quarts and pints. Before long the list included pounds of meat and cheese, quarts of ice cream, yards of material for new dresses, dozens of oranges, and so on. Pictures cut out of magazines or drawn by the children made the chart colorful and attractive. Tommy brought the bushel basket after his mother had canned the peaches and showed the children a bushel measure.

Measuring Quizzes

Match.

1. We buy milk	by the pair
2. We buy eggs	by the dozen
3. We buy meat	by the pound
4. We buy sugar	by the pair
5. We buy mittens	by the dozen
6. We buy shoes	by the yard
7. We buy ear-muffs	by the pound
8. We buy cloth	by the quart
9. We buy oranges	by the pair

Give children duplicated work sheets showing various measuring tools arranged in numbered rows. Use oral or written directions like these:

In Row 1 put an X on the tool we use to measure pounds.

In Row 2 put an X on the tool we use to measure yards.

Objective: To extend the idea that a fraction is part of a whole.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply concepts learned in 1A to 2B situations.

Help children recall what they know about fractions.

One half

Children should understand that if they want to have half of anything they must divide it into two parts, each part being just as large as the other. (Illustrate by folding a paper in half and cutting it. Give the halves to two children.)

One fourth

Children should understand that if they want to have a fourth of anything they must divide it into four parts, each part being just as large as the other three. (Demonstrate with paper.)

One third

Children should understand that if they want to have a third of anything they must divide it into three parts, each part being just as large as the other two. (Demonstrate with paper.)

Extend concepts of one half, one fourth, and one third concretely.

Divide children into groups and separate the groups into halves, fourths, or thirds.

Divide materials into portions of halves, fourths, and thirds. Be exact.

Divide paper plates into halves, fourths, and thirds. Color the sectional parts various colors. Let children superimpose the sections on a whole plate.

Bring halves, fourths, and thirds into every activity possible.

We Measure Water

Making jello requires measuring because the recipe calls for one pint of water. Since it isn't always convenient to have pint or quart measures around, children learn the *relationships* of the measures used in measuring liquids by pouring water from one measure into another. Then they make their own table of liquid measure for future reference.

We Measure Ribbon

The children have their "Mother's Day" booklets all ready to tie together with the ribbon they have bought. There is a yard each of blue, red, pink, yellow, lavender, green, purple, and orange.

Miss Terry tells them that if they divide each yard into thirds, everyone will have an equal share. She starts with the blue. First she measures it with the yardstick. Just a yard! The children know that a yard contains three feet; so Miss Terry has the children help her measure and cut off one foot at a time. Then they measure the thirds one against the other. All just the same size! Everyone is happy with his *one third* of a yard of pretty ribbon.

We Measure Milk

The recipe for cookies says *one-fourth* cup of milk. Just for fun (so the 2B's think) Miss Terry fills the measuring cup to the one-fourth line four times, each time pouring the milk into another container. The children keep count of the four fourths. Then Miss Terry pours the four fourths back into the measuring cup. Surprise! The cup is full. Four fourths make a whole cup!

Objective: To apply the arithmetic skills already learned to problem solving.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Apply problem-solving concepts learned in 1A to 2B situations.

Help children to solve the simple problems that are common to their daily living. School activities in which simple problems arise are suggested below.

1. Filling a Red Cross box
2. Selecting the best jumper to enter in the field meet
3. Getting ready for an exhibit
4. Planting garden boxes
5. Finding how many signs of spring (6 trees in bloom, 20 baby chicks, 4 robins)
6. Preparing a book corner (measuring space, grouping books)
7. Preparing a table of liquid measure.

Solving Problems

1. Children fill a Red Cross box with the following items:

toothbrush	25c
washcloth	10c
soap	10c
comb	10c
pencils	10c
writing pad	10c
toy	25c

Problem: How much does it cost to fill a Red Cross box?

Children can find total cost by "thinking money together" and totaling the equivalents:

5 dimes (10c) are 50c (half dollar)

2 quarters (25c) are 50c (half dollar)

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

8. Making clay animals for a farm (6 horses, 10 cows, 15 pigs, 25 chickens)
9. Telling time
10. Cutting paper for a mural (measuring craft paper with yardstick)
11. Making booklets
12. Finding the date for an exhibit

Have children dramatize problem situations.

Have children solve simple problems without use of written computation.

2. Children select the best jumper to enter in the field meet.
   Problem: Who jumped the farthest?
   Children can determine who jumped the farthest by measuring from toe line to point reached in the jumps.
3. Children plan an exhibit of their work for parents. There are 28 children in the room. Each child may show 2 pieces of work.
   Problem: How many pieces of work will the parents see?
   Children can count by twos to find the answer.
4. Children bring packages of seeds to school to plant in garden boxes. The girls bring 6 packages and the boys bring 2.
   Problem: How many more packages did the girls bring?
   Children can solve the problem concretely by matching girls' packages with boys' packages.
5. Children and teacher plan a walk to follow the art period. The art teacher comes at 2 o'clock. She stays 30 minutes.
   Problem: What time will the class go for a walk?
   Children can use the clock to count by fives.
6. The teacher announces the exhibit will be a week from Friday.
   Problem: What is the date for the exhibit? Children use calendar to find date.

Objective: To extend the use of vocabulary introduced earlier and to enrich it with new terms as needed.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Review 1A vocabulary.

Use correct arithmetical terms at all times.

Provide for the repetition of arithmetical terms in many situations so that meanings may be thoroughly established:

Through daily instruction

"Write the *date* on the *top* line."
"Write the *figures* on the *left* side of your paper and the *Roman numerals* on the right side."
"Write the ones *under* the ones' place."
"Fold your paper in *halves*."
"Fold your paper in *fourths*."
"Fold your paper in *thirds*."
"Put the *figures* on the *clock face*."

In daily activities

"My *score* is *less* than yours."
"What is the *total score?*"
"*How much* did he spend *all together?*"
"How much will it *cost?*"

Evaluation of Arithmetic Vocabulary

Evaluation of arithmetic vocabulary is more than just an occasional check-up in Miss Biers' room. It is a daily affair and is approached with the idea that the vocabulary should keep pace with the development and practice of growing number concepts.

By using a classified vocabulary list like the one Miss Brooks used in 1A, Miss Biers finds she is able to evaluate the children's vocabulary achievements.

She often gives what she calls a "Vocabulary Quiz Quickie." The test given below is one example of this type of quiz.

Name the *first* boy in the *last* row.
Name the *next* to the *last* boy in the *last* row.
Name the *second* boy in the *third* row.
Name as many things as you can that have the shape of a *circle*. (Wheel, coin, checkers, hoop, plate.)
Name as many things as you can that have the shape of a *square*. (Handkerchief, cracker, and the like.)
Name the number that comes *after* 25.
Name the number that comes *before* 25.
Name the number *between* 22 and 24.
Point to the *front* of the room.
Hold your hand *above* your head.

Objective: To have children review concepts learned at earlier levels and to extend them to include numbers from 150 to 200.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
Counting, number concepts, notation and numeration, and grouping have been developed in detail at earlier grade levels. Since 2A children are already familiar with these skills and concepts, an extension of them as needed in quantitative situations will be more valuable than further detailed drill. Review *Counting*, 2B. Extend concepts to include numbers from 150 to 200.	
Review *Number Concepts*, 2B. Extend concepts to include numbers from 150 to 200.	
Review *Notation and Numeration*, 2B. Extend concepts to include numbers from 150 to 200.	
Review *Grouping*, 2B. Extend concepts to include numbers from 16 to 18.	

Objective: To help children master the 28 addition facts whose sums do not exceed 6 and to help them use correctly the terms needed.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

SECOND SIX WEEKS

Record addition facts in groups for numbers 1 through 6. Record facts as they occur in daily activities. They need not be recorded in sequential order:

0	1	0		2	0	1		3	0	2	1				
0	0	1		0	2	1		0	3	1	2				
0	1	1		2	2	2		3	3	3	3				
4	0	3	1	2		5	0	4	1	3	2				
0	4	1	3	2		0	5	1	4	2	3				
4	4	4	4	4		5	5	5	5	5	5				
6	0	5	1	4	2	3									
0	6	1	5	2	4	3									
6	6	6	6	6	6	6									

Present addition facts for each number concretely, then abstractly, and then again concretely.

Record arrangements of groupings of bean bags, blocks, and counters and semiconcrete forms. (See "Presenting a Basic Fact.")

Make charts of each group of facts as they are developed for future reference.

THIRD SIX WEEKS

Introduce terms used in addition. (See "Addition Talk.")

Use games and exercises as practice for the 28 addition facts developed during the second six weeks period. (See "Addition Games.")

Give practice with semiconcrete materials. (See "Number Houses.")

Give practice in adding "unseen" number.

> Oral work: Have children add a dictated number to a number placed on the board. (Recall "counting on" from 1A and have children use this process "mentally" as aid to adding. Children give the sum orally.)

Give flash card drills.

Give concrete practice in adding three addends.

1	1	
2	11	(counters)
+ 3	111	
6	111111	

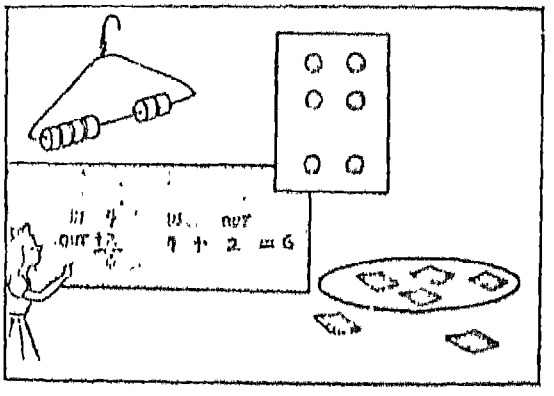
Presenting a Basic Fact

Miss Betz knew that her 2A's past experience with grouping had given them a good background for the addition facts. But she knew, too, that every basic fact must be associated in the child's mind with some experience he has had or can visualize if the fact is to be meaningful to him. So when it came time to present addition facts, she presented them concretely, then abstractly, and again concretely.

She began with a Bean Bag game. It required six bean bags, an abacus and an operator, a set of spot cards in patterns of six and an operator, and a recorder at the board.

The abacus and spot cards were placed in full view of the class.

Miss Betz explained that this was a game of sixes and that the idea was to determine not the highest score, but how many different score patterns could be made with six bean bags. She took the first turn, and her score pattern was four in and two out. The abacus operator reproduced it on the abacus. The spot card operator selected and showed the spot card with the correct pattern. And the recorder recorded the score pattern as follows:



4 + 2 = 6

$$\begin{array}{r} 4 \\ +\ 2 \\ \hline 6 \end{array}$$

Whenever a *new* pattern was "thrown," the same routine was followed. When the game was finished, the score board looked like this:

In	4	2	3	6	5
Out	2	4	3	0	1
	6	6	6	6	6

In		Out
4	+	2 = 6
2	+	4 = 6
3	+	3 = 6
6	+	0 = 6
5	+	1 = 6

Give oral practice in adding three addends. Explain the process in this way:

```
  3
  2
+ 1
---
  6
```

"Point to 2 and think five. Hold the number in your mind Point to 1 and say six."

Give written practice in adding three addends.

```
  3
  2
+ 1
---
  6
```

3 + 2 + 1 = 6

Give practice in checking answers.

Concrete:

000 + 00 = 5

00 + 000 = 5

Abstract:

```
  3     2
+ 2   + 3
---   ---
  5     5
```

(Have child cover answer and add up to check.)

Give examples with missing numbers.

3 + ___ = 4

```
  3
+ _
---
  4
```

Give examples with missing signs.

3 ___ 1 = 4

```
  3
  1
---
  4
```

The addition facts were left on the board. The next day the children took turns arranging books, pencils, blocks, and boxes of crayons, using only six of each. Then they reproduced each different arrangement on the abacus and recorded it in equation and column form. They added three new arrangements:

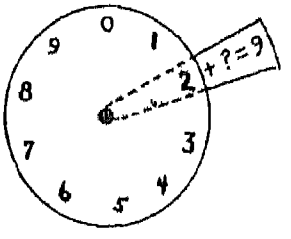
```
  6     0     1
+ 0   + 6   + 5
---   ---   ---
  6     6     6
```

Try as hard as they could, they could find only seven different ways to make six. Miss Betz then explained that there are only seven addition facts of six. They transferred the seven facts to a permanent chart and headed them "The 7 addition facts of 6."

Addition Games

The following games were among those that Miss Betz used for giving her children practice with the addition facts:

Racing Circle



Make a circle with a strip of cardboard fastened to back as shown in diagram. Children supply the missing addend. (Similar circles that give practice with combinations whose sums are 5, 4, 3, or 2 may be prepared.)

Number Bee

Use one set of number facts. Have children line up as for a spelling bee. Give each child a turn. Supply the correct answer when child gives wrong answer.

I'm Thinking

Leader: "I'm thinking of two numbers that make six."

Child: "Is it two and four?"

Leader: "No, it is not two and four."

Child: "Is it three and three?"

Leader: "Yes, it is."

Secret Code

Leader taps out an "addition" message:

— — — — — .

Child at board records the message in equation or column form:

3 + 2 = 5

```
  3
+ 2
---
  5
```

Ladder Game

Divide the class into two teams and place addition "ladders" on the board.

1st team	2nd team
4 + 1 =	2 + 4 =
2 + 4 =	4 + 1 =
2 + 3 =	1 + 5 =
3 + 3 =	0 + 6 =

A child from each team writes answers simultaneously. A perfect score gives a point to his team.

Addition Talk

Through constant usage *add, adding,* and *addition* had become a meaningful part of the 2A's vocabulary. Before introducing *addends,* Miss Betz explained the term: "We call the numbers that we put down to add, addends." From then on she always used the term when referring to numbers to be added. In the same simple manner she introduced other addition terms, such as *sum, plus, equals, column,* and *equation.* The children were quick to follow the teacher and soon used the terms easily.

A little later she introduced the term *example.* When the work sheets in addition were passed out, she told them that they were to do all the examples on the sheet. On another day she said, "With your counters you can find the sums for these examples I have written on the board." On every possible occasion she used the word *example.*

One day Bill said, "Miss Betz, I finished too soon, and so I made up some more examples."

"One more score for vocabulary," thought Miss Betz.

Number Houses

Miss Ebie drew a "number house" on the board.

"My number house has an upstairs and a downstairs," she said. "Who can tell me how many numbers live upstairs? Downstairs? In the whole house? Who can write the story on the board?"

"I have number houses for you." (She passed out number houses made of 9"x12" cardboard.) "I have number 'people' for you too." (She gave them counters.) "Today only six number people may live in your house. They may go upstairs and downstairs. I want to know what your number people do today. Here is a paper for you to write the stories on. See how many six stories you can make with your six number people and your number house. Write them." (Tall "three-story houses" may be used later if desired.)

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Addition Quiz Quickie

(Mimeographed sheet)

• : • : •	1 + 2 = 3		2 + 3 =		3 + 3 =		4 + 1 =		1 + 4 =		1 + 2 =
	4 + 2 =		5 + 1 =		2 + 4 =		6 + 0 =		0 + 6 =		3 + 2 =

Make dot pictures for each number story. Write the answer for each number story.

Objective: To help children master the subtraction facts corresponding to the 28 addition facts.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

THIRD SIX WEEKS

Record subtraction facts in groups for numbers through 6. (See *Addition of Integers.*)

0	1	1		2	2	2			
0	0	1		0	1	2			
0	1	0		2	1	0			
3	3	3	3		4	4	4	4	4
0	1	2	3		0	1	2	1	4
3	2	1	0		4	3	2	3	0
5	5	5	5	5	5				
0	1	2	3	4	5				
5	4	3	2	1	0				
6	6	6	6	6	6	6			
0	1	2	3	4	5	6			
6	5	4	3	2	1	0			

Present subtraction facts for each number concretely, then abstractly, and then again concretely.

Presenting a Subtraction Fact

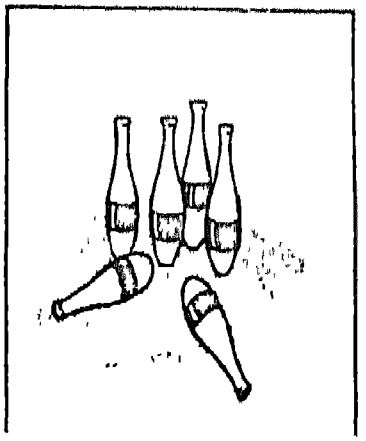
When Miss Betz is certain that the 2A's have a thorough understanding of the 28 addition facts for numbers through 6, she presents the corresponding subtraction facts. She first presents them concretely, then abstractly, and again concretely.

Tenpins is an ideal game for presenting the facts of six. The procedure is exactly the same as in presenting the addition facts. (See "Presenting a Basic Fact.") Only the computation of scores differs, as follows:

Oral report
Six pins *minus* two pins *leaves* four pins.
Written report

$$6 - 4 = 2$$

$$\begin{array}{r} 6 \\ -\ 4 \\ \hline 2 \end{array}$$



SUGGESTIVE ACTIVITIES | HOW SOME TEACHERS DO IT

Show how addition may be checked.

Concrete: 0000 — 00 = 00
000 — 00 = 0
00 + 00 = 0000

Abstract: 4 — 2 = 2
2 + 2 = 4

Give frequent and varied drill, using flash cards, board drill, quick quizzes.

Column form: 4
— 2

Equation form: 4 — 2 =

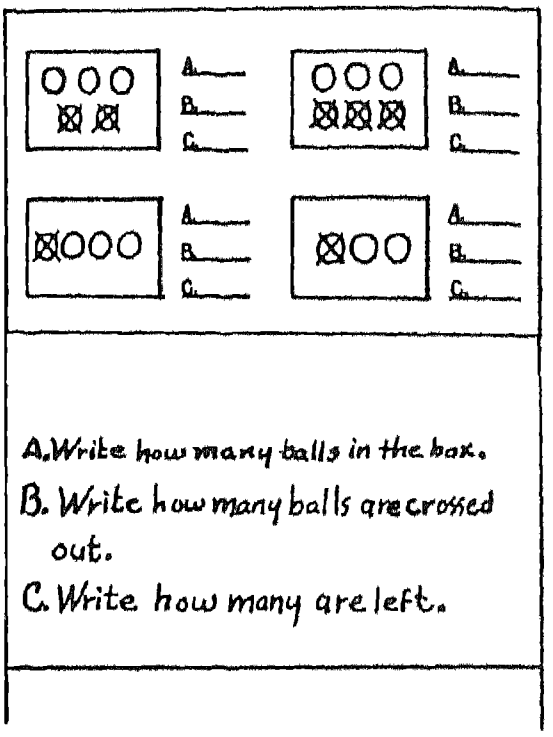
Missing number (both column and equation forms): 4 — ? = 2

4 — ? = 2

Missing sign (both column and equation forms): 4 ? 2 = 2

4 ? 2 = 2

A Subtraction Quiz Quickie



Subtraction Talk

Developing the idea of subtraction gives Miss Elbe many opportunities for developing the correct terms for the process:

"We *subtract* to find how many or how much is left when we take some away. James, please bring one box of scissors. Count them.

"Now lay eight scissors aside for table one. Count how many you have left.

"We had fourteen scissors. We took away eight scissors. Now we have six left. We can write it like this:

14
— 8
—
6

"Sometimes we say, 'Fourteen *minus* eight *leaves* six,' or 'Fourteen *less* eight is six.' We can write it like this:

14 — 8 = 6 or 14
— 8
—
6

"Do you remember yesterday when I said, 'We are *minus* two books'? Why did I say that?"

"Mary is seven years old today. Her brother in third grade is eight years old. What is the *difference* in their ages? Eight *minus* seven is one."

"Joan wants to buy a toy that costs 8c, but she has only 5c. *How much more* will she need?"

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Miss Elbe sometimes gives the children counters, puts examples on the board, and writes *subtract*. At first she has to read the word for them, but later they read it themselves and do just what it says to do.

In similar manner the words *subtract, subtraction, remainder, minuend,* and *subtrahend* are introduced. No formal drill is undertaken, merely constant correct usage of terms.

Objective: To extend concepts of units of measurement.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Coins

Review 2B section.

Extend experiences.

Have children make change for 20c

Have children make change for 25c.

Make chart showing value of coins. (Use actual coins.)

10 cents	o
1 dime	o
2 nickels	oo
10 pennies	ooooo ooooo
1 nickel & 5 pennies	o ooooo

1 quarter	o
25 pennies	oooooooooo oooooooooo ooooo
2 dimes & 1 nickel	oo o
1 dime & 3 nickels	o ooo

Continue to emphasize the use of the decimal point and dollar sign when writing amounts of money:

Red Cross money $1.25 (one dollar *and* twenty-five cents)

Milk money $1.65

Paper drive (total for school) $20.75

Extend and increase the appreciation of the purchasing value of various coins. (See "What Coins Shall We Use?")

Give oral practice in counting coins to get total amounts. (Demonstrate with two nickels and eight pennies, for example. Point to one nickel and say, "Five," the second nickel and say, "Ten"; then "count on" the pennies, saying: "Eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen." Write 18c as the total.)

Making Change

A bottle of milk and some pennies and nickels on Miss Harris' desk aroused considerable curiosity among the 2A children in her room. When arithmetic time came, Miss Harris said: "I bought this quart of milk this morning. It cost 14c. I gave the clerk two dimes. The clerk said: 'Fourteen cents, fifteen, and five make twenty.'"

As Miss Harris repeated what the clerk had said in making change, she held up the bottle of milk as she said "Fourteen cents," picked up the penny as she said ". . . fifteen," and picked up the nickel as she said ". . . and five make twenty."

"Who can tell me what the storekeeper would have said if the milk had cost 13c?"

One child pretended to be the clerk and counted the change, saying: "Thirteen cents, fourteen, fifteen, and five make twenty."

Miss Harris repeated this practice with different "clerks," using other articles and other amounts from 11c to 19c. Later, she let children count change for 25c. After much practice in making change in this way, the children were ready to conduct a sale or play store.

What Coins Shall We Use?

Miss Harris often has an interesting display when it is time for arithmetic. One day there were balloons, lollipops, cardboard ice-cream cones, a toy boat, a toy car, an airplane, a story book, and a ball. A price list was posted behind the display and a collection of pennies, nickels, dimes, and quarters lay on the table.

Miss Harris picked up a toy car and said, "What pieces of money will you need in order to buy this?" A child was allowed to select the necessary coins according to the price listed on the chart.

Miss Harris continued by asking what pieces of money one would need for one ice cream cone, for five ice cream cones, for two balloons, and so on.

How Much in All?

"How Much in All?" may be a blackboard assignment or a work sheet assignment. It is well to remind

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Give written practice in total amounts, using play money or pictured coins. (See "How Much in All?"). Call attention to chart showing value of coins.

Give written practice in value of coins, using play money or pictured coins (see "How Many Ways to Pay?"). Call attention to chart showing value of coins.

the children that they may help themselves by using what they know about counting by ones, twos, fives, and tens. They will write the total amount for each of the questions listed on a separate sheet of paper.

(Write how much in all.)

1. 1 nickel and 4 pennies?
2. 3 dimes?
3. 4 nickels?
4. 3 dimes and 5 pennies?
5. 6 nickels?
6. 2 dimes and 1 nickel?
7. 1 dime, 2 nickels, and 4 pennies?

How Many Ways to Pay?

"How Many Ways to Pay?" is an exercise which will help children to learn how coins may be combined to pay a given amount. A list of articles and prices is placed on the board:

top 5c	crayons 15c	doll 25c
boat 10c	jacks 8c	ball 20c

The children put down play money or real coins for each item in as many possible combinations as they can think of. For example, for a 25c doll they can put down five nickels, four nickels and five pennies, one quarter, two nickels and fifteen pennies, twenty-five pennies, or two dimes and one nickel.

locks

Apply concepts learned in 2B to 2A situations.

Extend experiences.

Make clock faces on cardboard, paper plates and the like.

Arrange hands on the clock faces to show time of regularly scheduled events. (See "Time for What?")

Make clock faces numbered with Roman numerals.

Make a schedule for a.m. and for p.m.

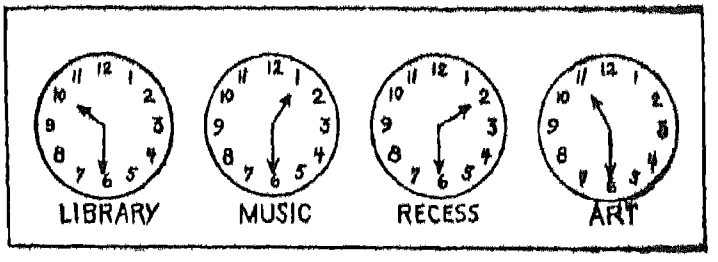
Have children practice telling time by hour and half hour.

Compare time units on daily schedule:

An hour for reading groups

A half hour for gym

Time for What?



alendar

Apply concepts learned in 2B to 2A situations.

Continue to use calendar daily.

Present names of months in sequence.

Make a chart of months in sequence, labeling each school month. (See "The Months of the Year.")

Present the seasons.

Make a story book of the seasons. (See "Learning the Seasons with Jimmy and Timmy.")

Record number of days in school months as they pass.

Record number of days in vacation months.

Make a diary for one or more months. (See "A May Diary.")

The Months of the Year

First:	January	Our Fifth School Month
Second:	February	Our Sixth School Month
Third:	March	Our Seventh School Month
Fourth:	April	Our Eighth School Month
Fifth:	May	Our Ninth School Month
Sixth:	June	Vacation
Seventh:	July	Vacation
Eighth:	August	Vacation
Ninth:	September	Our First School Month
Tenth:	October	Our Second School Month
Eleventh:	November	Our Third School Month
Twelfth:	December	Our Fourth School Month

Other Measurements

Apply concepts learned in 2B to 2A situations.

Extend meaning of liquid measurements to include quart, pint, half pint, cup.

Demonstrate these facts:

A quart of water will fill four measuring cups.

A pint of water will fill two measuring cups.

A cup of water will fill a pint bottle *half* full.

Prove by actual measurement that each child drinks one-half pint of milk at milk lunch time.

Show how useful a ruler and yardstick are in measuring the following:

Margins on paper (one inch)

Width of booklets (6 inches)

Ribbon for booklets (9 inches—¼ yard)

Paper for bulletin board

Height in feet and inches (see "Inches and Feet")

Continue to bring into social usage every measuring unit that can be used in a meaningful way:

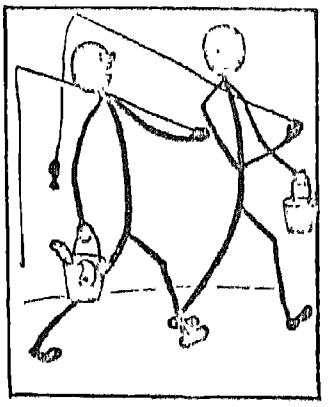
Thermometer

Stadiometer

Measuring spoons

Measuring vessels (gallon, bushel, and the like)

Learning the Seasons with Jimmy and Timmy



Jimmy and Timmy are stick-figure twins. Their adventures through the year may be told in picture and story according to the experiences suggested by the children.

For example, for the summer months of June, July, and August children suggest such activities as picnics, swimming, fishing, vacation trips with mother and daddy. For the spring season — March, April, May—children mention flying kites, playing marbles, making garden, and so forth.

The teacher should always emphasize the names of the months in the season.

A May Diary

On the first day of May, Ellen and her classmates each made a "skeleton" diary of 31 pages. Every day at evaluation time each child recorded by story or picture something he had done that day. When her diary was completed, Ellen was surprised to find how many things one could do in a month.

A Visit from the Milkman

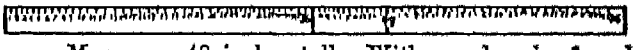
Look at Miss Harris' desk today! She has so many interesting surprises! The milkman has delivered three quarts of milk, one pint of cream, one quart of orange juice, and a quart of chocolate milk.

After the children discuss the contents, the amounts, and so forth, Miss Harris will give the following blackboard assignment. (All the bottles have signs designating their size and contents, so that children will have no language difficulties.)

1. How many quart bottles are there in all?
2. How many pint bottles are there in all?
3. Which is more, a pint or a quart?
4. Draw a picture of a quart bottle and a pint bottle side by side.
5. Is there as much orange juice as chocolate milk?
6. Is there more cream than milk?
7. Is there more chocolate milk than plain milk?

Inches and Feet

After the nurse had given the 2A children their last measurement check-up for the year, Miss Harris helped each one find his height in feet and inches. Two yardsticks were fastened to the bulletin board.



Mary was 48 inches tall. With a ruler she found that she was just 4 feet tall.

Jim was 52 inches tall. With a ruler he found that he was 4 feet, 4 inches tall.

Objective: To extend concept of ½, ⅓, and ¼ as equal parts of a whole.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
Apply 2B fraction concepts to 2A situations. Show the difference between "pieces" and equal parts. Bring into social usage at every opportunity the concept of one half, one third, and one fourth. Use pictures in exercises to emphasize the significant meanings of fractional parts.	

Objective: To help children acquire ability to use addition and subtraction facts as problem-solving techniques.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
Apply problem-solving concepts learned in 2B to 2A situations. Have children use addition and subtraction in meaningful situations: Comparing scores, prices, weights Playing store Giving a party Using or distributing materials	1. **Problems** Computing Scores Team A: John 3, Jack 1, Betty 2 = 6 Team B: Sue 2, Tom 1, Jim 2 = 5 Comparing Scores Team A 6 — Team B 5 6 − 5 = 1 2. My Weight Record Name *Betty* Weight this month *52* Weight last month *51* I gained *1 pound.* I lost ..... 3. John is the clerk in the play store today. He sold a balloon for 2c, a sucker for 1c, and a top for 4c. How much money did he take in? 2 + 1 + 4 = 7 2 + 1 + 4 = 7 4. Six lemons were needed for the punch for our party. Six girls volunteered to bring one each. Mary forgot hers. How many lemons have we? 6 − 1 = 5 Three boys and three girls were to bring one orange each. No one forgot. How many oranges have we? 3 + 3 = 6 3 + 3 = 6 5. There are 6 girls at Mary's table and she has 4 pieces of paper. Is it enough or too much? Will she need to get more or put some back? How many more? 4 + 2 = 6 4 + 2 = 6

Objective: To help children develop a rich and meaningful arithmetical vocabulary.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Review 2B vocabulary.

Use correct terms at all times.

Provide opportunities for repetition of terms in a variety of situations so that meanings will become well established.

Say As I Say

Although 2A children need not learn to read or spell many arithmetical terms, they do learn the meaning of terms if they constantly hear and repeat them.

The teacher should emphasize arithmetical terms as they arise in daily situations:

"Make your *column* of *addends* straight."

"The *minus sign* means *subtract*."

"The *answer* in *subtraction* is the *difference*."

"Make the tree trunks *thicker*."

"Jerry's team has the *least* number of points."

"Make the *margin narrower*."

"Bring *another* book."

"We *collect* waste paper."

"*Measure* the length of the paper."

"My *total score* is six."

"*Double* your thread."

"*Several* children are absent."

"Bring the *fact* cards."

Put a line under the largest number in each row.

151	154	153	
126	134	122	
171	169	173	178
199	159	188	166
183	185	176	140

Put a line under the smallest number in each row.

180	176	159		
122	154	112		
172	171	168	169	180
193	184	195	172	140
150	163	149	180	171

187 means ..... hundreds .... tens and ..... ones.
140 means ... . hundreds .. .. tens and .... ones.
151 means .... hundreds ..... tens and .... ones.
162 means .... hundreds ..... tens and .... ones.
173 means ..... hundreds ..... tens and ..... ones.

Write the number.

ten .....
fifteen .....
nineteen .....
twenty .....
thirteen .....

Place an X after odd numbers.

10 ....
21 ....
3 .....
1133 .....
1468 .....

2A ARITHMETIC TEST (Continued)

Place an X after even numbers.

12 .....
13 .....
125 .....
1116 .....
1248 .....

Write the numbers.

I .....
VI .....
X .....
IX .....
XII .....

Write the sums.

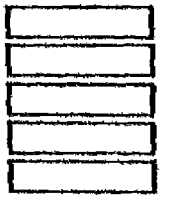
2	5	2	0	3
+ 3	+ 1	+ 4	+ 6	+ 0
___	___	___	___	___

Write the remainders.

4	3	6	4	6
— 1	— 2	— 0	— 2	— 3
___	___	___	___	___

Write the number on these price tags.

Fourteen cents
Twenty-five cents
One dollar
One dollar and twenty-nine cents
Two dollars



Show five ways to pay for a toy that costs 25 cents.

.....
.....
.....
.....
.....

What number comes after 152? .....
What number comes after 198? .....
What number comes after 146? .....
What number comes after 125? .....
What number comes after 133? .....
What number comes before 183? .....
What number comes before 174? .....
What number comes before 161? .....
What number comes before 154? .....

What number comes between these numbers?

170 172
195 197
143 145
168 170
182 184

Write the missing number.

4	3	3	4	6
+	+	+	+	+
___	___	___	___	___
5	5	6	6	6

Write the missing signs.

3	4	5	5	4
3	1	1	1	1
___	___	___	___	___
6	3	4	6	5

2A ARITHMETIC TEST (Continued)

Bill bought a top that cost 11c. He gave the clerk 2 dimes. How much change did Bill get? .....

A dime is ..... cents.
A nickel is ..... cents.
A quarter is ..... cents.
A quarter is ..... dimes ..... nickel.
A dime is ..... nickels.
There are ..... seasons in a year.
There are ..... months in a year.
There are ..... days in a week.
Do we get up in the a.m. or the p.m.? .....
Do we go to bed in the a.m. or the p.m.? .....
There are ..... pints in a quart.
There are ..... cups in a quart.
There are ..... eggs in a dozen.
There are ..... feet in a yard.

Write the sums.

3	2	3	4	4
2	0	1	1	2
1	4	2	1	0
—	—	—	—	—

Joe had 4 rabbits. Mother gave him 2 more. How many rabbits did Joe have then? .....

Six girls came to play with Susan. Two girls went home. How many girls were left to play with Susan? .....

GRADE THREE

Grade 3

Grade 3 features a mastery project on the number system. Regrouping of numbers in the processes of addition and subtraction is developed and extended.

Development of 100 basic addition and 100 basic subtraction facts is completed. Mastery of the facts, sums, and minuends through 12 is recommended. Ability to use the addition and subtraction facts and processes with facility in solving one-step problems is extended. Number concepts are extended through 200 .

Continued emphasis is placed on solving various types of one-step problems. The following skills are further developed:

Choosing numbers when unnecessary data are involved

Comparing the answer with the problem to see if it is reasonable

Thinking critically in estimating answers to problems and checking or proving results.

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	Topics	Objectives, Concepts, and Understandings	References and Activities
Numbers and Number System	Reviewing Counting by 1's, 2's, 5's, 10's from 1-200 Concepts of odd and even Ordinals through tenth Relationship, meaning, and value of numbers 1-200 Roman numerals I-XII Mastery Project 3.1, Number System	To recall counting knowledge, knowledge of odd and even numbers, and ordinals learned at earlier levels To recall and maintain skill in reading and writing numbers, number words and Roman numerals learned at earlier levels	Counting All activities restricting ordinals to first ten, p. 81 Inventory, Achievement, and Mastery Tests in Growth in Arithmetic and other adopted textbooks Appendix for sample of Project 3.1
	Reading and writing of numbers through hundreds, ordinals beyond tenth as needed Grouping and regrouping 2-place numbers Place value ones and tens places Meaning of zero as not any or none Grouped and ungrouped values of dollars and cents	To extend the regrouping of numbers from one place value to another place value, based on the notational system of ten To develop a feeling of ten-ness with respect to the number system	Counting, p. 81 No restrictions on ordinals in meaningful situations Notation and Numeration, p. 82 Number Concepts, p. 21 Regrouping, pp. 22, 23 Appendix
Processes with Integers	Addition Reviewing The 72 addition facts sums through 12, Column equation and missing number form Introducing the 28 addition facts, sum 13-18. Use in examples Column form, 2 and 3 addends, including zeros 7 3 8 -8 2 0 -7 -4 Missing number form 4 + ? = 3	To develop accuracy in using addition facts learned at earlier levels To extend the concept, use, and process of addition to include facts with sums 13-18	Addition of Integers, p. 95 Adapt to facts of sums through 12 Addition of Integers, p. 89 All activities Arithmetic Exercises and Problems Book I, pp. 38-43 Table of 100 basic additio facts, Appendix, p. A3

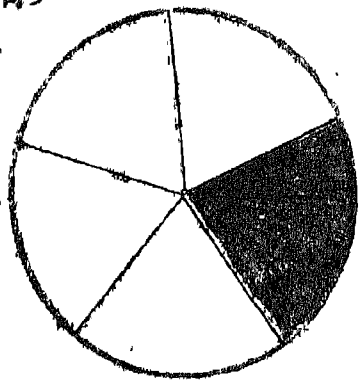
Grade Three
First Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Processes with Integers	Equation form 8 + 9 = 17 8 + ? = 16 Two-place numbers, 2 addends, last sum 9 or less 13 70 +25 +28 Two-place numbers, 2 addends, last sum 10 through 18, including zeros and empty spaces 84 90 16 85 42 89 92 23 Subtraction Reviewing The 72 subtraction facts minuends through 12 Column, equation, and missing number forms	To increase appreciation of the need for knowing facts To present adding of 2-place numbers, 2 addends with sums of 3-place numbers To develop accuracy in using facts through sums of 12 To review terms take-away, left	Addition of Integers, p. 90 Omit portion on adding by endings Adopted textbook Subtraction of Integers, p. extend to include 72 subtraction facts Arithmetic Exercises and Problem Book II, pp. 16-20
	Terms Subtract, subtraction, difference, remainder, minus, less, minuend, subtrahend, as needed in the learning process Introduce the 28 subtraction facts minuends 13 through 18 Use in examples Column form 17 -8 Missing number form 17 -9 Equation form 17 - 8 = 9 17 - 9 = 8	To maintain earlier learnings To extend the use and process of subtraction to include minuends 13-18 To extend use of terms used in subtraction	Subtraction of Integers, p. 9 extend to include new facts (minuends 13-18) More Clues, p. 92 It Helps to Know, p. 92 Do It Our Way, p. 93 Appendix Table of 100 basic subtraction facts Appendix p. A4 Adopted textbook Arithmetic Exercises and Problems Book I, pp. 67-69

Processes with Integers

Topics	Objectives, Concepts, and Understandings	References and Activities
Examples Two-place minuends and 2-place subtrahends, including zeros and empty spaces Introducing 3-place minuend and 2-place subtrahends, including zeros 109 119 110 117 -32 -83 -40 -80		Subtraction of Integers, pp. 91-95 Do It Our Way Survey Test
Checking Cover minuend, add subtrahend and remainder, compare sum with minuend		Arithmetic Exercises and Problems Book I, pp. 21-26, pp. 46-53
Multiplication		
Terms Times, multiply, multiplication as needed in the learning process	Multiplication is a short way of combining groups of equal size.	Multiplication of Integers, pp. 123, 124
Manipulative development of multiplication: 1. 2 times facts and their reverses through products of 18 Two 4's are 8 4 + 4 = 8 2 x 4 = 8 4 x 2 = 8		Concrete development of all facts 1. Two 5's are 10 5 + 5 = 10 2 x 5 = 10 □□□□□ □□□□□ □□□□□□□□□□
2. 5 times facts and their reverses through products of 15 Three 5's are 15 5 + 5 + 5 = 15 3 x 5 = 15 5 x 3 = 15		2. Five 2's are 10 Ten is 2 + 2 + 2 + 2 + 2 5 x 2 = 10 □□ □□ □□ □□ □□ □□□□□□□□□□ Adopted textbooks

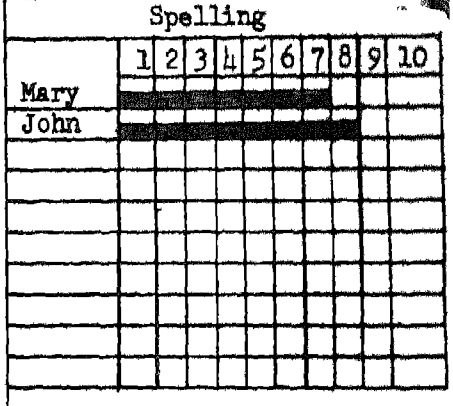
Grade Three
First Nine Weeks

Topics	Objectives, Concepts and Understandings	References and Activities
<u>Division</u> No introduction of division this nine weeks		
Reviewing 1/2, 1/4, 1/3	To develop the concept that a fractional part is one of a given number of equal parts of the whole	Fractions, p. 102
1/5  1/5	To understand that one of the five equal parts of the whole is 1/5	Fractions, pp. 102, 103 Adapt activities to 1/5 Adopted textbook
Extending decimals Dollars and cents in problems using new addition and subtraction facts	To develop use of the decimal as a cents point in problems involving money	Adopted textbook Point up a Technique, p. 85

Measurement and Statistics

Topics	Objectives, Concepts, and Understandings	References and Activities
Reviewing Telling time to quarter hours, a.m., p.m. Calendar, names and sequence of months in a year, names of months in each season, days in months, weeks in a month Change for 25¢ Equivalents to 25¢	To recall that measurement is a comparison with a standard unit of measure	Measurement, pp. 95, 96
Extending telling time to quarter hour to be written 2:15, 2:45 and 15 minutes until three o'clock Money Writing dollars and cents through $1 and above as needed Reading the same amounts in examples and problems Recognizing and using dollar sign and cents point Coins Equivalents of coins to one dollar	To extend the ideas of measurement developed at earlier levels	Measurement, p. 96 Adapt reading of quarter hour to new learning (15 minutes until three o'clock) All activities, p. 97

Three
Nine Weeks

Topics	Objectives, Concepts, and Understandings	References and Activities
ıge .05 through $1.00 ındar new work gth tended use of linear ısure, foot, inch, e-half inch, yard ing tape measure ght und, half-pound, and nce		Pages 98, 99 to second six weeks work Adopted textbook
ing mple bar graph as for elling urate statements in terms comparison, from graphs, "John spelled correctly more word than Mary."	To develop the ability to read data from a simple bar graph	
oblems involving ocesses, techniques, and ills as they become derstandable to ildren al problems involving ouping and regrouping al problems involving mbining equal groups	To develop the ability to do quantitative thinking in problem situations	Problem Solving, p. 103, under Suggestive Activities Vocabulary, p. 105 under Suggestive Activities

	Topics	Objectives, Concepts, and Understandings	References and Activities
Mathematics in Human Affairs	Money Problems related to other school subjects and activities Preparing for school Cost of school supplies, school clothes, etc. Skill in counting Making change	To develop an appreciation of the fact that the arithmetic of money is important in our daily living.	Social Studies Unit Money

'ade Three
:cond Nine Weeks

Topics	Objectives, Concepts, and Understandings	References and Activities
)unting from 1-200 by 1's, 's, 5's, and 10's	To increase skill in using knowledge of our number system	Counting, pp. 80-81
id and even numbers		Notation and Numeration, pp. 82-86
rdinals through twelfth beyond as far as meaningful situations occur)		
eading and writing numbers hrough thousands as needed, n sequence and in isolation	To understand the regrouping of numbers from one place value to another in readiness for regrouping in addition and subtraction	Adopted textbooks
ords for numbers through wenty		
eaning and value of numbers o thousands, including zero s a place holder		
egrouping numbers, ones to ens; tens to ones; hundreds o tens developed with epresentative materials		Grouping and Regrouping, pp. 21, 22 (review) pp. 109, 110 (extend)
10 ones exchanged for 1 ten (pennies, dimes)		Appendix,
1 ten exchanged for 10 ones (dimes, pennies)		
10 tens exchanged for 100 ones (dimes, pennies)		
100 ones exchanged for 10 tens or for 1 hundred (pennies, dimes, dollars)		
epeat regrouping activities sing abacus, counters, and lace value charts		

Topics	Objectives, Concepts and Understandings	References and Activities
Addition		
Reviewing Addition facts, sums through 18	To maintain skills acquired at earlier levels	Arithmetic Exercises and Problems, Book I, pp. 63-72
Adding by endings with sums in the same decade 8 18 5 15 +0 +0 +2 +2	To understand the relationship of a basic fact in the lowest decade to higher decade addition, no regrouping involved; adding by endings	Addition of Integers, p. 90 Adding by Endings
Addition facts, sums through 18 Column form 7 +9 Missing number form 7 +? 16		Practice in using addition facts, Arithmetic Exercises and Problems, Book II, p. 43; pp. 63-65; p. 67; pp. 68, 69; 71, 72, using only the addition exercises. Regrouping in Addition, pp. 109, 110
Equation form 7 + 9 = 16	To introduce the use of regrouping in addition where the sum of the digits in any of the places is more than 9, and to extend the understanding of place value 25 = ? tens and 5 ones 16 = 1 ten and 6 ones 3 tens and 11 ones = 3 tens and 1 ten and 1 one = 4 tens and 1 one = 41	Arithmetic Exercises and Problems, Book II, pp. 10-24 Regrouping from Tens Place, Appendix
Examples Single column, 3 addends sums 19 or less involving adding by endings See: 8, 4, 7 — Think: 12, +7 Check Adding upward		
Addition of 2-place numbers involving regrouping ones to tens; 3-place numbers involving ones to tens 166 +255 Tens to hundreds 166 +253 Ones to tens to hundreds 166 +257		

de Three
ond Nine Weeks

Topics	Objectives, Concepts and Understandings	References and Activities
Subtraction		
iewing btraction facts, nuends through 18	To maintain skills acquired at earlier levels	
btraction facts sums ough 18 lumn form ssing number form uation form mples ree-place minuends, and 3-place subtrahends ith zero difficulties	To extend use of the new basic facts	Regrouping from tens and hundreds places, Appendix Arithmetic Exercises and Problems Book I, pp. 27, 28 Subtraction of Integers, pp. 118-120 We Learn to Borrow Borrowing Twice Omit last example using 2 zeros; use term regrouping in place of borrowing
troducing regrouping lace numbers, regroup- g from tens place 52 -16 ast remainder, a zero ot recorded in answer 73 -68 wo-place minuends, -place subtrahend 56 - 8 wo-place numbers with egrouping, and no re - rouping wo- and 3-place numbers, egrouping from tens place nly 845 -226	To introduce the use of regrouping in subtraction where the subtrahend in any of the places is larger than the minuend and to extend the understanding of place value 52 = 5 tens and 2 ones -16 = 1 ten and 6 ones = 4 tens and 12 ones - 1 ten and 6 ones 3 tens and 6 ones	Arithmetic Exercises and Problems Book II, pp. 38-43

Topics	Objectives, Concepts, and Understandings	References and Activities
Three-place numbers regrouping from hundreds place only $7.38 -2.56 Checking Adding three-place numbers Regrouping from tens and hundreds place Multiplication Reviewing 2-times facts 5-times facts (No mastery)	To maintain and reinforce concept of multiplication as an efficient way of combining equal groups	
Terms Multiplicand, multiplier as needed Times, product Multiplication by 2 Examples 2-place multiplicand last product 8 or less 12 x 2 = 22 x 2 = 23 x 2 = 42 x 2	To introduce the use of multiplication in combining larger groups; use of 2-place multiplicand	Multiplication of Integers, pp. 123, 124
Adding by endings Add 1 to any of the 2-times facts 2 x 4 + 1 = 9 2 x 6 + 1 = 13 2 x 8 + 1 = 17 Add 1, 2, 3, or 4 to any of the 5-times facts 5 x 3 + 2 = 17 5 x 5 + 3 = 28 5 x 8 + 4 = 44 5 x 6 + 1 = 31 Practicing with 5's	To introduce carry facts as a readiness for regrouping in multiplication Concept Multiplication and addition used together to complete an operation in problem solving Understanding The number added to a times fact should always be less than the multiplier	Arithmetic Exercises and Problems Book II, p. 64 Follow manipulative development (shown below) with Racing Circle game, p. 118 /// /// /// /// /// 3 3 3 3 3 //////////////// + / = 15 + 1 = //////////////// 16

ade Three
cond Nine Weeks

Topics	Objectives, Concepts and Understandings	References and Activities
Division		
ıtsoducing Equal parts of numbers that are multiples of 2 and of 5 (Concrete development) 2 equal parts of 2, 4, 6, 8, 10, 12, 14, 16, 18 3 equal parts of 3, 6, 9, 12, 15, 18 4 equal parts of 4, 8, 12, 16, 20 5 equal parts of 5, 10, 15, 20, 25, 30, 35, 40, 45 6 equal parts of 6, 12, 18, 24, 30 7 equal parts of 7, 14, 21, 28, 35 8 equal parts of 8, 16, 24, 32, 40 9 equal parts of 9, 18, 27, 36, 45	To develop the concept of equal parts of numbers in readiness for division To develop the concept of separating groups for two purposes To find the number of equal parts of a given size (measurement) To find the size of a given number of equal parts (partition)	Division, pp. 125, 126 Manipulative development to find the number of equal parts of a given size as the number of groups of 2 in 12 Use 12 one-counters, grouping them in 2's Discovery In 12 things there are 6 groups of 2 things Manipulative development to find the size of a given number of parts as the size of each of the 5 parts of 15 or 1/5 of 15 Use 15 one-counters; distribute to make 5 groups Step 1 Distribute 5 counters to start 5 groups Step 2 Distribute 5 more counters, adding 1 counter to each of the first five counters Step 3 Distribute 5 more counters adding 1 counter to each the five groups of 2 Discovery The size of 5 equal groups in 15 is 3

	Topics	Objectives, Concepts, and Understandings	References and Activities
Fractions, Ratio, and Proportion	1/2, 1/4, 1/3 with respect to a whole unit 1/2 and 1/5 of in meaningful situations Decimals Dollars and cents in problems using new addition and subtraction facts	To extend the concept of 1/2 and 1/5 as one of a given number of equal parts of a whole or a group To introdude the concept of 1/2 of and 1/5 of as meaning to divide by 2 or by 5 To introduce the concept of fractions to compare little with big: Half as long	Fractions, pp. 135, 136 For extension and enrichment 1/2, 1/4, see Manual to Scribner Arithmetic, p.90 Adopted textbook
Measurement and Statistics	Maintaining and extending skills Time Calendar Liquid Extending half pint, pint, quart, gallon Thermometer Money Change to $1.00 cents point and dollar sign Postage stamps 2¢, 3¢, 6¢ Other measures as needed	To maintain the concept of measurement as a comparison with a standard unit of measure To extend and increase skill in using units of measures	Measurement, pp. 96-99 Any activities on these pages not previously covered Arithmetic Exercises and Problems Book I, p. 57 Measurement, pp. 100, 101 Ways of Measuring Temperature Measurement, p. 101 A Visit from the Nurse Reading a Wall Thermometer Stamps on the Job Adopted textbook

Grade Three
Second Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Graphs and Functional Relationships	Making and using simple graphs Pupil-teacher activities such as diagrams to show relations between quantities A picture graph to show relation of number of boys to girls in the class	To extend ability to read and explain data from simple graphs	Pupil-teacher project Making a graph
Mathematical Reasoning	Problems involving addition and subtraction facts, sums, and minuends through 18 Oral problems involving the separating of a group to find the number of equal parts of a given size Oral problems involving the separating of a group to find the size of a given number of equal parts	To develop ability to use facts previously learned in problem solving	Problem Solving, pp. 103, 105 Vocabulary, Suggestive Activities, p. 105 Adopted textbooks
Mathematics in Human Affairs	Money Problems relating to school activities which involve the handling of money Skill in counting Skill in making change	To extend the concept that people need to use the arithmetic of money in their daily living	Social Studies Unit Money

	Topics	Objectives, Concepts, and Understandings	References and Activities
Numbers and Number System	Reviewing Value and meaning of numbers through thousands Reading and writing of numbers through thousands Ordinals through tenth Roman numerals I-XII Reading and writing words, one-twenty	To maintain skill in reading and writing of numbers To reinforce the concept of the value and meaning of numbers and place value	Notation and Numeration, p. 106 Arithmetic Exercises and Problems Book II, pp. 1,2
	Extending Reading and writing numbers in thousands Dollars and cents related to computations, involving facts of addition, subtraction, and the multiplication facts of 2's and 5's Roman numerals to XX	To extend skill in reading and writing numbers, using the dollar sign and cents point, and in using Roman numerals	Notation and Numeration, p. 107 Breaking Numbers into Parts Adopted textbooks
Processes with Integers	Addition Reviewing 100 basic addition facts	To maintain skill in using addition facts, sums through 18	Manual for Scribner Arithmetic, p. 184 I'm Thinking--- Number Fact Relay Climb the Ladder
	Adding by endings, bridging 10's for use in column addition 13 + 7 = 43 + 7 =	To introduce bridging tens	Addition of Integers, pp. 114-118 Arithmetic Exercises and Problems Book II, pp. 34,35 Practice Material, Appendix

Grade Three
Third Nine Weeks

Processes with Integers

Topic	Objectives, Concepts, and Understandings	References and Activities
Examples Three-place numbers 2 addends, where the 3-place number is added to 2- or 1-place numbers, involving carrying 28 8 346 479 Three-place numbers carrying to zeros and 9's, including empty spaces 498 806 64 228 187 689 Checking Subtraction Reviewing The 100 basic subtraction facts	To introduce difficulties in addition pertaining to empty spaces and zeros To maintain skill in using subtraction facts, minuends through 18	Regrouping Appendix, [illegible] Manual for Scribner Arithmetic, p. 185 Card games Climb the Ladder Number Fact Relay Adapt to subtraction
Examples Two and 3-place minuends and subtrahends, zero difficulties with regrouping 70 800 -26 -89 With empty spaces 181 666 [illegible] -95 -54 [illegible] Checking	To introduce difficulties in subtraction pertaining to empty spaces and zeros To maintain skill in checking subtraction introduced earlier	Subtraction of Integers, pp. 121, 122 Adopted textbooks

Processes with Integers

Topics	Objectives, Concepts, and Understandings	References and Activities
Multiplication Reviewing 2-times facts 5-times facts	To maintain skill in multiplication facts of 2's and 5's	Practice material in adopted textbooks
Extending Multiplication by 2 2-place multiplicands, last product 10 or more, no regrouping 52 x2 2-place multiplicands, last product 9 or less regrouping 25 x2 2-place multiplicands last product more or less than 10, no regrouping 2-place multiplicands last products 9 or less, regrouping 2-place multiplicands, last products 10 or more regrouping 3-place multiplicands, no regrouping	To introduce the concept that tens are multiplied in the same way that ones are multiplied To introduce the use of regrouping in multiplication, and to extend understanding of place value 25 = 2 tens and 5 ones x 2 = x 2 Change the 10 ones for one ten 4 tens and 10 ones = 4 tens and 1 ten = 5 tens or 50 To extend the understandings and use of adding by endings to multiplication involving regrouping 25 x 2 Multiply ones 2 x 5 = 10 ones Change 10 ones for 1 ten and 0 ones Write the o under ones place in the answer Hold the 1 ten 25 x 2 0 Multiply the tens, 2 x 2 = 4 tens 4 tens - 1 ten (held) = 5 tens Write 5 tens in the answer under tens place 25 x 2 0	Scribner Arithmetic, pp. 254, 255 Arithmetic Exercises and Problems, Book II, pp. 64-69

Grade Three
Third Nine Weeks

Processes with Integers

Topics	Objectives, Concepts, and Understandings	References and Activities
Manipulative development Multiplication by 5 2-place multiplicands, no carrying, and carrying Multiplication facts 3-times facts 4-times facts and reverses		Arithmetic Exercises and Problems, Book III, p. 64 Adopted textbooks Multiplication of Integers, pp. 127-129
Division Extending Division facts of 2 Division facts of 5 Even division by 2 2-place dividend 2- and 3-place dividends Even division by 5 Manipulative development Equal parts of numbers Multiples of 3 and of 4	To extend the measurement concept of division to finding the number of equal parts of a given size by subtracting Problem How many 5's in 25? Solution How many 5's can be taken from 25? 25 - 5 20 - 5 15 - 5 10 - 5 5 - 5 Five 5's can be taken from 25, so there are five 5's in 25	Division of Integers, pp. 128-132 Learning About Division Developing a Fact Chart for Division Dividing a Two-Place Number Dividing a Three-Place Number Adopted textbooks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Fractions, Ratio, and Proportions	Reviewing 1/2 of, 1/5 of 1/2, 1/5 Dollars and cents	To maintain concepts of fractions developed at earlier levels	Use fractions in meaningful classroom situations
	Extending 1/3 of a group Decimals Dollars and cents using number facts and processes already introduced	To extend the concept of fractional parts of a group as another step in division To practice using the dollar sign and cents point	Adopted textbooks
Measurements and Statistics	Reviewing Foot, inch, half-inch, yard, pound, ounce, half-pint, pint, quart, gallon, temperature, time to a minute Making change 5¢ to $1.00	To maintain skills in measurement developed earlier	Arithmetic Exercises and Problems, Book I, pp. 57, 58 83-85
	Continuing Comparisons and equivalents for all measurements Making change to $1.00 (beyond as needed) Introducing abbreviations Pt., qt., gal., in., hr., yd., min., wk., mo., lb., doz.	To maintain knowledge of and use of all measurements introduced earlier To introduce abbreviations for units of measurement	Arithmetic Exercises and Problems, Book II, pp. 29, 30 Adopted textbooks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Mathematical Reasoning	Continuing Bar graph usage	To maintain and extend function and use of simple bar graph	Construct (pupil-teacher activity) A pictograph showing quantitative comparison such as the speed of a letter by air versus train or speed of air travel versus car travel
	Extending Oral problems involving the 2's and 5's times facts Oral problems involving comparisons and equivalents in measurements	To promote transfer of understandings and skills to problem solving as problems occur in daily activities	Problem Solving, pp. 136, 1 Vocabulary, p. 138
Mathematics in Human Affairs	Problems related to all school subjects and activities Oral problems arising from a study of Denver Taxes Bus schedules Water rates Traffic fines Others as suggested	To point up the concept that arithmetic is part of every activity in our daily living	Social Studies Unit Living in Denver

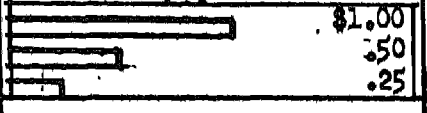
	Topics	Objectives, Concepts, and Understandings	References and Activities
Numbers and Number System	Reviewing Reading, writing, meaning and value of numbers in hundreds and thousands Reading and writing dollars and cents Roman numerals to XX Reading number words through hundred	To maintain skills and understandings in notation, numeration, and place values	Notation and Numeration, pp. 106, 107 Adopted textbooks Arithmetic Exercises and Problems, Book II, pp. 1, 2
	Maintaining meaning and value of numbers through thousands Dollars and cents Using multiplication facts of 3's and 4's	To maintain and extend understandings in notation, numeration, and place value	Notation and Numeration, pp. 106, 107 Arithmetic Exercises and Problems, Book II, pp. 32, 3
Processes with Integers	Addition Reviewing All facts, skills, and techniques developed previously	To increase facility in using facts, skills, and techniques developed at earlier levels	Adopted textbooks Arithmetic Exercises and Problems, Book I, II (Any lessons on addition not used previously)
	Extending 1- and 2-place numbers with 3 and 4 addends Checking Add upward	To increase skill in column addition	Arithmetic Exercises and Problems, Book II, pp. 36, 3 Practice Material Appendix

Grade Three
Fourth Nine Weeks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Processes with Integers	**Subtraction** Reviewing All facts, skills, and techniques developed in 1st, 2nd, 3rd 9-week periods No new work	To increase facility in using facts, skills, and techniques developed at earlier levels	Adopted textbooks Arithmetic Exercises and Problems, Book I, II Any lessons on subtraction not used previously
	Multiplication Reviewing All facts, skills, and techniques developed in 2nd and 3rd 9-week periods	To maintain concepts, understandings, and skills in multiplication of integers	Practice material in adopted textbooks
	Reviewing Multiplication by 5, three-place multiplicands No regrouping Regrouping from ones place Regrouping from tens place Regrouping from ones and tens place Multiplication by 3 2-place multiplicands last products 9 or less No regrouping 2-place multiplicands last products 10 or more No regrouping 2-place multiplicands, last products 9 or less, regrouping 2-place multiplicands, last proucts 10 or more, regrouping		Arithmetic Exercises and Problems, Book II, pp. 64 Adopted textbooks

	Topics	Objectives, Concepts, and Understandings	References and Activities
Processes with Integers	3-place multiplicands, no regrouping Multiplication by 4 2-place multiplicands, no regrouping 3-place multiplicands, no regrouping zero difficulties 901 x 4 510 x 4		Arithmetic Exercises and Problems, Book III, pp. 48, 4
	Division Reviewing Even division by 2 and 5 Division facts of 2, 3, 4, 5	To maintain skill in doing even division developed at earlier levels To work toward mastery of division facts of 2, 3, 4, 5	Division of Integers, pp. 129, 132
	Even division by 3 2-place dividends 3-place dividends Even division by 4	To increase skill in using the division facts of 3 and 4 in doing even division	Arithmetic Exercises and Problems, Book II, pp. 80-83, Book III, p. 73 Adopted textbooks
Fractions, Ratio, and Proportion	Reviewing 1/2 of, 1/3 of, 1/4 of, 1/5 of as steps in division by 2, 3, 4, 5 Dollars and cents using number facts and processes Dollars sign and cents point	To maintain and to increase facility in the use of fractional parts as related to division	Adopted textbooks
	No new work		

Grade Three
Fourth Nine Weeks

Topics	Objectives, Concepts, and Understandings	References and Activities
Reviewing All measurements introduced in 1st, 2nd, 3rd 9-week periods Abbreviations	To use knowledge of measurements, gained at earlier levels, in new situations	Classroom activities Adopted textbooks Arithmetic Exercises and Problems, Book II, pp. 52, 5 (test)
No new work		
Reviewing Reading data from simple bar graph	To maintain skill in reading and interpreting a simple bar graph	See 1st, 2nd, 3rd 9-week periods
Making a graph to show the comparative values of dollar, half-dollar, quarter  	To extend use of graphs to representing comparative values on a simple bar graph	Measurement, p. 98 Adapt equivalents chart to bar graphs
Problems related to other school subjects and activities involving All facts and processes learned at earlier levels Measurement Choosing numbers when unnecessary data are involved Labeling answers	To develop ability in the art of problem solving that goes beyond the computation involved	Arithmetic Exercises and Problems, Book I and II Any problem solving activities not previously used Adopted textbooks

Grade Three
Fourth Nine Weeks

Topics	Objectives, Concepts, and Understandings	References and Activities
Analysis of problems Spotting the question involved Seeing the facts that are given Deciding on the best process to use		
Problems related to other school subjects and activities Bulletin board arrangements for displays Measurements, adapting shapes to space	To become increasingly appreciative of the role of arithmetic in our daily activities	Social Studies Unit Learning about Plants

VOCABULARY

add	divisor	height	remainder
addend	dollar bill	herd	remains
addition	duet	inner	result
amount	equal	length	subtract
answer	equals	minuend	subtraction
apiece	equally	minus	subtrahend
between	equation form	multiply	sum
borrow	example	multiplicand	thousand
check	exercise	multiplication	times
column form	far, farther, farthest	multiplier	toward
combinations	few, fewer, fewest	narrow, narrower	total
compare	figure	narrowest	trio
crowd	flock	outer	triple
date	gallon	price	underneath
distance	half dozen	process	value of
divide	half pint	product	worth
division	halves	quotient	

Symbols used in primary grades:

+	a.m.	o degree (temperature)
-	p.m.	¢
x	?	$
÷	=	

Children in the third grade should be feeling very much pleased with their ability to use arithmetic in solving almost any situation they are required to meet. It is important at this stage to extend this feeling of confidence and to continue to put into constant use the skills as they are further developed.

The following outline suggests ways of doing this during the routine of a school day. It is offered as a possibility and not as a prescribed pattern for a day's activities.

DAILY ACTIVITIES	ARITHMETIC UNDERSTANDINGS
Orientation Observing notation for the current year Recording Red Cross contributions	Meaning of numbers (1954: One thousand, nine hundred fifty-four years) Writing of money Arranging in proper columns (dollars, cents) Using correct signs (dollar sign, decimal) Adding a column of figures Vocabulary *Column, addends, decimals, sum*
Reading Arranging groups	Fractions in meaningful situations (¼ of the group for library reading; ¾ of the group for supervised work)
Art Designing and making spelling books	Measuring (inch, half inch) Use of ruler as a tool for measuring
Physical Education Planning the game of "Three Deep"	Dividing (How many groups of three from 31 children?)
Library Period Computing fine on overdue books	Odd and even numbers (Thirty is an even number; 31 is an odd number. One child is left over.) Vocabulary *Divide, odd, even, left over, remainder* Multiplying (Three days overdue at 2c per day 3 × 2c = 6c)
Language Setting the date for a program	Reading the calendar (Christmas comes on Thursday. Christmas vacation begins on the *Tuesday before* the twenty-fifth of December. Our program will be the Friday *before* that. The date of our program will be . ...)
Projects Observing price tags at a neighborhood store Evaluating paper drive for the room; noting increase or decrease from previous drive	Reading money (Wagon $3.95. Doll $.99) Vocabulary *Price, dollar, cents* Subtracting $6.38 first drive 5.29 second drive $1.09 difference Vocabulary *Minuend, subtrahend, difference*

Objective: To recall counting knowledge gained at earlier levels.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

ALL SEMESTER

Recall counting by 1's to 200.

Have pupils do the following:

Count from one given number to another: 75 to 95; 70 to 100; 175 to 200; 130 to 155

Supply the missing numbers in a series: 145 .... 148 152

Play games which emphasize the use of numbers in a series (See "Lotto.")

Recall counting by 2's, 5's, and 10's to 200.

Have pupils do the following:

Count by tally marks used in games: 𝍸

Count pennies stacked in 5's and in 10's

Count to mark passage of time, as in Hide and Seek: by 10's to 100; by 10's from 100 to 200

Count from given numbers: by 2's from 122 to 142; by 5's from 150 to 200; by 10's from 130 to 200

Fill in blanks, counting by 5's: 60 105

Fill in blanks, counting by 2's in the first group and by 10's in the second: 182 .... 192; 130 180

Play games calling for counting by 2's, 5's, 10's (See "Pick Up Sticks.")

Lotto

Materials: a pack of cards to be used by the leader, each card containing one of a selected series of numbers; a larger card for each child, *each different from the others*, containing portions of the selected number series; small objects (buttons, beans) for markers.

The leader draws one card from his pack and calls out the number on it. Each player having that number on his card covers the number with a marker. When one player has all the numbers in one column on his card covered, he is the winner.

116	150	90	99
117	151	91	100
118	152	92	101
119	153	93	102
120	154	94	103
121	155	95	104
122	156	96	105
123	157	97	106
124	158	98	107

6" x 8" for child

Variations depend upon the numbers used on the cards.

152	119

1½" x 3" for leader

Pick Up Sticks

One player allows a handful of sticks to drop hit or miss on the table. He picks up one stick at a time, trying not to move any of the others. If he moves another stick, the turn passes to the next player. The winner is the player with the most points at the end of the game. Points are assigned to sticks by color as follows: red sticks, 5 points; blue sticks, 1 point; green sticks, 10 points; yellow sticks, 2 points. The player must announce his color when he takes his turn and must pick up only sticks of that color. He counts score as he picks up sticks.

Objective: To recall knowledge of odd and even numbers gained at earlier levels.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Review *Counting*, 2A.

Arrange teams by having children number off, odd numbered children stepping out to form one team, even numbered children the other.

Give written exercises to check understanding of odd and even numbers. (See "What's the Address?")

What's the Address?

Pupils draw seven houses, the first numbered 103 and the last numbered 115.

"These houses stand on the odd numbered side of the street. Some have no numbers. Look at the first and last numbers and fill in the missing numbers."

Similar exercises with lockers, post office boxes, and the like may be used.

Objective: To extend and check the child's understanding and use of ordinals.

SUGGESTIVE ACTIVITIES

Use ordinals to designate the following:

The order in which children or teams finish a game or a task

The order in which daily activities or scheduled events occur

Pages of a book

Hooks for wraps

Children for various activities

Use ordinals in giving directions for the following activities:

Preparing paper headings or papers

Preparing seatwork

Passing out materials

Use ordinals in reading numbers on the calendar in daily calendar activities. Have children read birthdays, holidays, and scheduled events as ordinals.

Test for understanding and skill in using ordinals. (See following test.)

Ordinal Test

Give written directions for mimeographed pictures:
The dog is leading the parade. He is first in the line.

All the others are following him.

1. Which animal is third?
2. Which animal is fifth?
3. Which animal is second?
4. Which animal is tenth?
5. Which animal is fourth?

Yes, No

1. The dog is first in the line.
2. The horse is ninth in the line.
3. The monkey is eighth in the line.
4. The tiger is twelfth in the line.
5. The bear is eleventh in the line.
6. The rabbit is second in the line.
7. The second animal in the line says, "Mew."
8. The tenth animal in the line says, "Moo."

HOW SOME TEACHERS DO IT

Making Sure of Ordinals

Children in 3B are usually quite familiar with ordinals; nevertheless Miss Baird is careful to plan for their continued use and for their extension in any situation which offers an opportunity. The daily discourse in her 3B group includes such remarks as these:

Tom finished *tenth.*

Music is the *first* period after lunch.

Halloween comes on the *thirty-first* of October.

Mary sits in the *sixth* seat of the *fourth* row.

The picture is on the *twelfth* page of your books.

No one is using the *eleventh* hook. Tom may have it for his wraps.

John's birthday is September *fourteenth.*

Begin writing your story on the *twelfth* line so that you will have room at the top for your picture.

Our flower show is September *fifteenth.*

Today is the *twelfth* of September.

The pupil in the *fourth* seat of each row may pass the books.

The *fifteenth* of September comes on Thursday.

Objective: To review and extend skills in the reading and writing of numbers.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Review *Notation and Numeration*, 2A, adapting activities suggested there to current situations. (See "Reviews Can Be Fun.")

Extend the reading and writing of numbers to 500.

Have pupils write in missing numbers from a given number to another given number: 200 ..... 204.

Let children play games which require the use of numbers in a series. (See "Just Any Game Won't Do.")

Ask pupils to arrange numbers in the order of their size: 220, 228, 241, 233

Have pupils read numbers in serial order: two hundred five, two hundred six, and so on.

Have pupils circle the largest number in a group and the smallest number in a group.

Help pupils to make number charts showing that 500 is 5 100's. (See "A 500 Number Chart.")

Reviews Can Be Fun

Knowing from past experience that 3B pupils are eager to get into third grade work, Miss Martin approaches review work as a "showing we are ready" time. She makes a point of the idea that when everyone shows that he remembers his second grade work, the third grade work will be much more fun.

Recalling their achievement chart of last year, the children decide to make a readiness chart so that they will know exactly when all are ready.

We Are Ready

My Name	Relationship Meaning Value 1-200	Reading 100-200 Words one-twenty	Roman Numerals I-XII	Writing Numbers 1-200	Writing Words one-twenty	Grouping 1-18	
Mary	Ready	Ready		Ready		Ready	
John							
Tom							

Oral and written tests follow up units of daily activities and help to determine when a child may mark "Ready" by his name. The extra column at the extreme right is reserved for review of words *eleven* to *twenty* in the third six weeks.

Just Any Game Won't Do

"If a game is to be used as a vehicle for arithmetic learning, it should be worthy of its mission," said Miss Martin.

"For example," Miss Martin continued, "we use games in the arithmetic period only to facilitate arithmetic learning. Carelessly chosen, poorly organized games will result in hazy arithmetic understandings and poor habits of number manipulation."

Then Miss Martin listed her criteria for a worthwhile arithmetic lesson via a game:

Use a game with emphasis on mental rather than physical achievement.

Give accurate directions for playing the game.

Select capable leaders for the game.

See that the entire group participates.

Evaluate the results.

Have pupils use the number chart for practice in reading and writing numbers from 200-500:

Reading the numbers by 10's from 210-250

Beginning with 320 and reading the numbers to 380

Saying the numbers by 1's that belong between 460-500

Writing the numbers of the 210 column, arranging each digit in the correct space

Tens	Hundreds	Ones
2	1	0

Writing numbers from dictation

Enrich the understanding of the way numbers are used to give order to things by having pupils do the following:

Recall the numbering of houses (See *Counting.*)

Notice the order used in numbering rooms in the school building.

Basement rooms—below 100

First floor—100's

Second floor—200's

Notice the order used in numbering rooms in public buildings that they visit, such as those listed below, and report their findings to the class:

Hospitals

City and County Building

Office buildings (dentist, doctor)

Recall the order of numbering book pages (See *Counting.*)

Discover that knowing the serial order of numbers is a great advantage in our work and play because numbers may be used to give order to such things as the following:

A story

A set of papers

Cards or pictures in a file (See "Order in the Files, Please.")

A 500 Number Chart

10	110	210	310	410
20	120	220	320	420
30	130	230	330	430
40	140	240	340	440
50	150	250	350	450
60	160	260	360	460
70	170	270	370	470
80	180	280	380	480
90	190	290	390	490
100	200	300	400	500

Order Pays Off

"This book has come apart, and the story is all mixed up," wailed Ellen, bringing the disordered pages of a favorite book from the library.

"We know how to take care of that," said Miss Martin. "The pages are all numbered, as you know. Lay them one by one in the order of their numbers, and the story will be all straightened out. Then we will ask the librarian to rebind it."

"Remember," warned Bill, "the even numbers are on the pages at the left, and the odd numbers go to the right."

In no time at all Ellen had all the pages in order, ready for the librarian. As Miss Martin took the book she smiled at Ellen and said, "I'm glad you are a good counter, Ellen, so that I don't have to do all the jobs round here."

Order in the Files, Please

201	206	211	216	221	226	231	236
202	207	212	217	222	227	232	237
203	208	213	218	223	228	233	238
204	209	214	219	224	229	234	239
205	210	215	220	225	230	235	240

Miss Martin's pupils are used to filing things in order and are careful to keep their files straight. Usually the card or picture is numbered in the upper right-hand corner on the back. But when Miss Martin made their new Lotto cards, she decided that using the numbers on the face of the cards for filing would give additional practice in learning the serial order of numbers. The children caught on quickly after Miss Martin proceeded carefully the first day as follows:

"The first card in our new set ends with the number 210," said Miss Martin, writing the number on the board.

"If you have that card, pass it in. . . . Each card has ten numbers. What number will the next card end with? Bring it. . . . If we always file the cards in this order, we can quickly find any card we want."

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils read and write addition and subtraction facts as they acquire intelligent control over them in meaningful situations.

Recall to pupils the table of 28 addition facts and 28 subtraction facts.

Arrange the 36 new addition and 36 new subtraction facts in a similar table for permanent use. (See "Table of Facts.")

Soon the responsibility for filing the cards is given to the leader of the group.

Table of Facts

36 New Addition Facts

6	1	3	2	5	4	7	0		
1	6	4	5	2	3	0	7		
7	7	7	7	7	7	7	7		
7	6	2	1	3	5	4	8	0	
1	2	6	7	5	3	4	0	8	
8	8	8	8	8	8	8	8	8	
8	2	7	1	3	6	4	5	9	0
1	7	2	8	6	3	5	4	0	9
9	9	9	9	9	9	9	9	9	9
9	1	2	8	3	7	4	6	5	
1	9	8	2	7	3	6	4	5	
10	10	10	10	10	10	10	10	10	

36 New Subtraction Facts

7	7	7	7	7	7	7	7		
6	1	4	5	2	3	0	7		
1	6	3	2	5	4	7	0		
8	8	8	8	8	8	8	8	8	
7	6	2	1	5	3	4	0	8	
1	2	6	7	3	5	4	8	0	
9	9	9	9	9	9	9	9	9	9
8	2	7	1	3	6	5	4	0	9
1	7	2	8	6	3	4	5	9	0
10	10	10	10	10	10	10	10	10	
9	1	8	2	3	7	6	4	5	
1	9	2	8	7	3	4	6	5	

Have children do the following:

Read and write numbers 500 to 1000 as they occur in meaningful situations.

Read and write the 26 new addition and 26 new subtraction facts as they occur in meaningful situations. (See list at right.)

Arrange the 52 new addition and subtraction facts in a table for permanent use.

26 New Addition Facts

9	2	3	8	5	6	7	4
2	9	8	3	6	5	4	7
11	11	11	11	11	11	11	11
9	3	8	4	5	7	6	
3	9	4	8	7	5	6	
12	12	12	12	12	12	12	
9	4	5	8	6	7		
4	9	8	5	7	6		
13	13	13	13	13	13		
7	6	8	9	5			
7	8	6	5	9			
14	14	14	14	14			

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils write dollars and cents as they occur in problems and examples. Continue to stress the meaning and use of the dollar sign and decimal point in reading and writing amounts of money.

Have children read and write numbers 1000 to 2000 as they occur in meaningful situations. For example, pupils might do the following:

Write house numbers and telephone numbers for a directory

Read and write automobile license numbers

Record distances traveled on a trip

Write costs of such things as automobiles

Help pupils to read and write the 10 new addition and 10 new subtraction facts as they occur in problems and examples or other meaningful situations. (See list at right.)

Make a table of the new facts for permanent use.

Extend the meaning of value of numbers 200 to 2000. Help pupils to do the following:

Recall the meaning of these numbers: 9, 99, 999

1-place	2-place	3-place
9	99	999

26 New Subtraction Facts

11	11	11	11	11	11	11	11
9	2	3	8	6	5	4	7
2	9	8	3	5	6	7	4
12	12	12	12	12	12	12	
9	3	8	4	5	7	6	
3	9	4	8	7	5	6	
13	13	13	13	13	13		
9	4	5	8	6	7		
4	9	8	5	7	6		
14	14	14	14	14			
7	6	8	9	5			
7	8	6	5	9			

Pointing Up a Technique

"I know how to write one thousand dollars," boasted Johnny. "My dad had to pay $1000 on our house last night."

"That's fine, Johnny," Miss Martin commented. "Perhaps you'd like to write it on the board for us."

Bill wasn't satisfied with the way Johnny wrote $1000. "Where's the cents point?" he asked.

The ensuing discussion showed, however, that most of the class understood why Johnny didn't use a decimal point. Amounts requiring its use were put on the board, such as $1.65, $2.35, $4.25, $10.95, $10.00, $120.50.

Miss Martin felt sure that the time used as a result of Johnny's urge to show off a new accomplishment was worth while. The decimal point had not received such sharp attention for quite some time.

Personalized Directories

The approach of Mary's birthday party, for which invitations were being sent, was the impetus for making individual directories of house numbers and telephone numbers. Some children wanted everyone listed in their books, but most of them confined the list to those with whom they associated the most.

A committee was chosen to compile a "master" directory to be kept in the room library for reference. In the neighborhood where Miss Martin's group lived, house numbers ranged from 900 (or less) to over 4000.

Table of Facts

Addition

9	6	8	7	7	9	8	9	8	9
6	9	7	8	9	7	8	8	9	9
15	15	15	15	16	16	16	17	17	18

Subtraction

15	15	15	15	16	16	16	17	17	18
9	6	8	7	7	9	8	8	9	9
6	9	7	8	9	7	8	9	8	9

SUGGESTIVE ACTIVITIES

Discover the need for 4-place numbers (See "Dead End Numbers.")

Direct practice so that pupils will gain an intelligent control of 4-place numbers: position of units—tens, hundreds, thousands—and the value of zero as a place holder.

1203

3 is in the ones' place; it means there are 3 ones, or 3

0 is in the tens' place; it means there are no tens, or 00

2 is in the hundreds' place; it means there are 2 hundreds, or 200

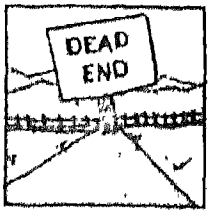
1 is in the thousands' place; it means there is 1 thousand, or 1000

1203

Review words for numbers 11 through 20. (See "We Are Ready" chart.)

HOW SOME TEACHERS DO IT

"Dead End" Numbers



Nearly everyone in Miss Martin's room knew the meaning of a "dead end" street, and many had related experiences which they wished to share with the class. When Miss Martin said that she called 9, 99, and 999 her "dead end" numbers, they caught what she meant very quickly. "You can't go any farther without adding another place."

They tried it. From 9 (1-place) they went to 10 (2-place); from 99 to 100 (3-place). Then Susan rushed ahead to exclaim, "And from 999 we have to go to 1000."

Then there was the matter of labeling the new place. They began at the right with the places they knew and placed each digit where it belonged: no ones, no tens, no hundreds, and *1 thousand.*

thousands	hundreds	tens	ones
1	0	0	0

Then they really had fun. Everyone was eager to show that he could tell what each number in a 4 place number meant so that he would get to write it under the others on the board. At the end of the arithmetic period that day, the board list was evidence that Miss Martin's "dead end" numbers, like a dead end street, had necessitated a new way onward.

The Adding Machine Helps

Miss Martin has a habit of arousing the curiosity of her pupils with something unusual, and on this particular day it was with an adding machine.

"Let's see if this adding machine knows about 'dead end' numbers," she said. "Let's punch the '9' button and see what happens. Who would like to try?"

Bobby tried and reported that the machine put a '9' on the paper. Several more tried it and reported the same thing.

"Now let's have the machine add 1 to the 9. Who will punch the 1 for me?" asked Miss Martin.

Carol volunteered and reported that the machine had put a '10' on the paper. They tried it over and over with all the "dead end" numbers—9, 99, and 999. Every time the machine used one more place when it added on a 1.

"We can't fool this machine," said Tommy. "It knows about 'dead end' numbers."

"I don't believe we can fool any of you, either," said Miss Martin.

Objective: To extend the concept of the use and process of addition and to help children master the 72 addition facts having sums 7-18 as they become meaningful

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Recall and enrich the concept of addition.

Draw from past experiences to renew the concept, the language, and the process of addition·

Treat quantitative situations concretely, then abstractly, and again concretely. (See "Presenting a Basic Fact")

Use terms needed in the addition process at every opportunity. (See "Addition Talk.")

Have children do the following:

Practice addition in column, equation, and missing number forms (See *Addition of Integers*, 2A.)

Consider some of the ways by which they may add to what they already have (See "Getting More")

Find addition problems from original experiences suggested by the pictures in "Getting More," such as this experience which Billy recalled: "My grandfather gave me five ducks, and I bought three more with money from my bank. How many do I have all together?"

Look for words that help them know if they should find the sum (See "Word Clues to Addition.")

both, together, the two, total, all together, three, in all, for all, sum

Practice using these clues in problems arising out of concrete classroom experiences

Isolate from classroom problems those addition facts whose sums are 7-10 and record for follow-up drill (See *Notation and Numeration*, for list.)

Compare ease and quickness of problem solving with known combinations and unknown combinations to discover the advantage of being able to give automatic response to number combinations

Formulate a program (pupil-teacher planning) for mastery of addition facts:

Selecting drill material

Combinations immediately useful

Unit of material small enough to insure mastery in a reasonably short time

Selecting devices for drill (See "Drill Devices.")

Fact cards

Flash cards

Games

Evaluating progress

Charts (individual and group)

Achievement cards (individual)

Measuring results

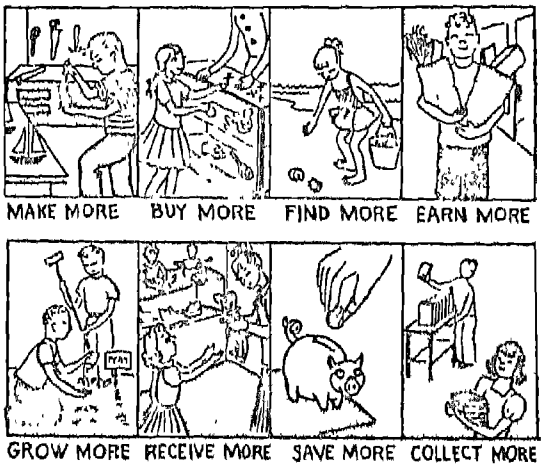
Speed drills

Oral tests

Written tests

Getting More

The heading "Getting More" on Miss Martin's bulletin board was intriguing, and the pictures below it were more so. Miss Martin had been collecting them for the specific purpose of showing the various ways that people increase their possessions. No doubt every child would find here a circumstance with which he was familiar or one which reminded him of a similar one that he could share with the class and make into a problem to be solved.



Word Clues to Addition

"If you know how to find and follow a clue, you will be a good sum detective," Miss Martin told her 3B's. Then she read them some stories to show them what she meant. They played detective and listed on the board the clues they found that told them they were to find the sum. This is their list:

How many marbles did Tom have *all together*?

How many dolls did *both* children have?

How many boats did the *two* boys have?

How many cookies did Mary and Tim *together* have?

How much did she spend for *all* the toys?

How many jacks did she have *in all*?

What is the *total* amount spent for the party?

What is the *sum* of these two numbers?

Drill Devices

Miss Martin uses the following drill devices *only* after the children have a thorough understanding of the addition process and a valid reason for mastering addition combinations:

Racing Circle

I'm Thinking

Ladder Game

Number Bee

Provide practice for pupils to increase facility of recall and to increase appreciation of the need for knowing addition facts and processes as follows:

Have pupils use the 36 addition facts whose sums are 7-10 to solve problems encountered in daily experiences:

Having a sale (flower, paper, and the like)

Selling tickets for a school movie or entertainment

Making cards for number games

Determining number of pages in a book assignment

Keeping game scores and computing team totals

Figuring total amount of money for school lunch, milk lunch, and various funds being collected (as Community Chest)

Filling a Red Cross Box

Decorating Easter eggs

Planning a room party

Use activities connected with units of work in various subjects which present problems to the group and to the individual child. (See "You Can't Get Away From It.")

Drill pupils on these addition facts for complete mastery.

Have children practice these addition facts in abstract examples.

Help pupils to discover a new step in adding a single column with 3 addends (adding a *seen* number to an *unseen* number). (See "Adding Three Addends" and "Adding With Zeros.")

Help children to discover a need for addition which involves 2-place numbers, 2 addends, and no carrying.

Examples:

Find number of children taking milk.

14 girls
12 boys
—
26

Add scores of boys and girls to get totals.

52 boys
41 girls
—
93

Test for mastery of facts.

Miss Martin offers fact cards to the children as a means of self-improvement. The child looks at the study side of a card, repeats the combination and answer until he thinks he knows it, turns the card over and visualizes the answer under the fact, and lays it, test side up, with other cards for testing.

When he feels ready to test himself, he holds a card, test side up, says the answer, turns the card over, and checks his answer. If his answer is incorrect, he places that card aside for future study.

You Can't Get Away From It

"Do we have to do arithmetic today?" asked Susie, who was having a little difficulty in that area.

"No-o-o," said Miss Martin, "perhaps it would be a good idea to have one day without it. You needn't do a thing today that requires any arithmetic."

Miss Martin went to the board and wrote, "No arithmetic allowed in this room today."

The whole group was alerted by that declaration. It didn't sound like Miss Martin, because she thought arithmetic was very important.

"It's my turn to mark the calendar and write the date on the board," announced Ellen.

"Oh, we'll have to skip your turn, Ellen," said Miss Martin. "That's arithmetic, and we aren't having any today."

Ellen sat down, rather crestfallen. But that was only one of many curtailments the day's activities suffered because of the "no arithmetic allowed" idea.

Jack missed his turn to record attendance on the board, Bill his turn to serve the milk, and Susie her turn to count out the art supplies. Such chores require arithmetic.

The ball game at recess time was canceled. Scoring requires arithmetic.

The group missed a [illegible] move its racing car ahead in the P.T.A. [illegible] No counting of money or computing of standings!

Miss Martin had to arrange to postpone lunch payments that day—money transaction requires arithmetic.

Social studies activities were canceled. Building a radio station necessitates measuring, estimating, computing.

Language, spelling, and reading all lost some of their zest: no dates on papers, no numbering of words, no finding of the story by page number.

So many other curtailments occurred that the group came to evaluation time with a thwarted, confused feeling rather than one of satisfied achievement, as was usual.

" 'No arithmetic' isn't such a good idea," said Bill. "We can't have much fun without it. We just can't get away from it."

SUGGESTIVE ACTIVITIES

Add 26 addition facts whose sums are 11-14, to pupils' store of arithmetic facts. (See *Notation and Numeration.*)

Have pupils practice these facts in classroom situations.

Drill on these facts for complete mastery.

Provide practice with these facts in abstract examples.

Give practice in adding 2-place numbers, 2 addends, last sum 10-14, including zeros and empty spaces. (See "Watch Those Places.")

Help pupils to discover a new, quick way to add by endings. (See "Adding by Endings.")

Have children practice adding, by endings. Children should add orally, giving a *single response* to each of these facts, as "Thirteen and one are fourteen."

14	13	12	11	10	13	12	11	10	
0	1	2	3	4	0	1	2	3	
12	11	10	11	11	11	11	10	10	10
0	1	2	0	1	2	3	0	1	2
10	10								
3	4								

Test for mastery of facts.

HOW SOME TEACHERS DO IT

Adding Three Addends

Miss Martin knew from experience that any trouble her pupils would have in adding three addends would probably come from inability to remember the unseen number. So she started with the six examples one can make from the numbers 1, 2, and 3 because the sums could be found quickly and easily.

1	2	1	3	3	2
2	1	3	1	2	3
3	3	2	2	1	1

She continued with other groups of three addends in which the totals did not exceed 10. In all, there are 31 of such groups:

1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	2	2
1	2	3	4	5	6	7	8	2	3

1	1	1	1	1	1	1	1	1	1	2
2	2	2	2	3	3	3	3	4	4	2
4	5	6	7	3	4	5	6	4	5	2

2	2	2	2	2	2	2	2	3	3
2	2	2	2	3	3	3	4	3	3
3	4	5	6	3	4	5	4	3	4

All but three of these can be made into other examples and be presented in the order of their degree of difficulty, thus affording extensive practice.

1	2	3
1	2	3
1	2	3

Adding with Zeros

Often in recording game scores the zero was used to indicate that a child had played but had not scored; while the zero did not change the total score, it served to show how many "turns" there had been. The zero had been recognized as a place holder in other situations also. (See *Notation and Numeration*, and *Problem Solving.*)

Now that it is to be encountered as an addend, Miss Martin considers her pupils quite ready to accept it and use it as such.

Watch Those Places

Miss Martin's habit of anticipating the difficulties children may have and of providing for the bridging of them probably accounts for the smooth progress they make in arithmetic.

Zeros and empty spaces had been encountered frequently in other situations.

Ten Pins

Team 1		Team 2	
Bill	2	Jim	4
Tom	1	Ann	0
Sue	0	Jean	0
Jack	3	Bob	1
Mary	2	Gary	3
	8		8

Boys	8c
Girls	21c
	29c
29c today	

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils complete the 100 addition facts by learning the 10 facts whose sums are 15, 16, 17, and 18.

Help pupils to apply knowledge of combinations to classroom situations.

Use examples with sums 19 or less, involving adding by endings.

Use examples with 2-place numbers, 2 addends, last sum 18 or less.

Use examples that involve adding by endings within the same decade, sums 19 or less.

See that pupils practice all addition by adding down for the sum and adding up to check.

Test for mastery of facts.

Test for concepts and skills.

The children learned to place numbers in the right place.

8	*not*	8
21		21

They understand quite well the meanings of ones', tens', and hundreds' places; so Miss Martin feels that a brief discussion at this point in their adding experience, followed by occasional warnings, is sufficient. She takes the class through one example:

hundreds	tens	ones
	8	4
	4	2
1	2	6

"Eighty-four is 8 tens and 4 ones. Forty two is 4 tens and 2 ones. Adding the ones we have 6. Adding the tens we have 12. Counting 12 tens we have 120, which is 1 hundred and 2 tens. Now we put the 6 in the ones' place, the 2 in the tens' place, and the hundred in the hundreds' place. Then the sum is written correctly."

Adding by Endings

Miss Martin showed her pupils how she saved time and work in adding such numbers as 11 or 12.

0	2

She put

1	11
0	0

on the board and said,

"One and 0 are 1, and so 11 and 0 have to be 11." She put

2	12
2	2

on the board and said,

"Two and 2 are 4, and so 12 and 2 have to be 14."

Everyone had a turn with examples on the board, going through the process orally and recording the sum.

The children quickly saw the advantage of the one-step process, and Miss Martin was pleased that they were thinking in terms of adding 2 to 12 rather than adding two groups of addends, that is, 2 + 2 and 1 + 0.

A Survey Test on Concepts and Skills in Addition

Directions: Write the sums. Check all answers.

16	95	26	83	40	21	12	20	31
3	45	32	14	59	46	56	50	30
40	54	83	71	71	83	90	63	1
36	30	35	41	57	44	35	53	62
20	4	20	11	7	14	63	85	62
8	11	5	8	12	2	53	22	33
98	92							
10	32							

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Copy these numbers and add. Check all answers.
20 and 40, 14 and 3, 26 and 3, 15 and 4, 54 and 11.
Write the numbers that come after these numbers:
69, 49, 79, 29, 13, 45, 24, 15.
Add. Check all answers.

6	7	5	6	9	9	3	7	6	4	8
2	3	5	5	2	2	9	3	5	8	0
8	4	8	5	8	7	2	9	7	2	1

How many ones are there in the ones' place in 49?
How many tens are there in 68?
How much more than 20 is 21?
How much more than 10 is 9 and 3?
How many hundreds are there in 103?

Objective: To extend the concept of the use and process of subtraction and to help children master the 72 subtraction facts corresponding to the addition facts having sums 7-18 as they become meaningful.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Recall and enrich the concept of subtraction

Draw from past experiences to renew the concept, the language, and the process of subtraction.

Treat quantitative situations concretely, then abstractly, and again concretely. (See "Presenting a Subtraction Fact.")

Use terms needed in the subtraction process at every opportunity. (See "Subtraction Talk")

Have children do the following:

Practice subtraction in column, equation, and missing number form using the 28 subtraction combinations learned at earlier levels.

Consider some of the ways by which they may have less than they had to start with (See "Having Less.")

Find subtraction problems from original experiences suggested by the pictures in "Having Less," such as this one Susan recalled:

"I got 4 balloons at the circus. My kitten caught one and broke it How many balloons did I have left?"

Look for word clues that will help them know that they are to find a *remainder* or a *difference* (See "More Clues.")

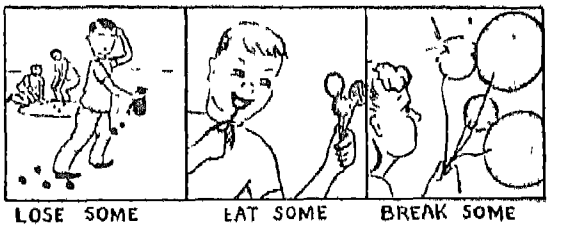
Practice using these clues on problems arising out of concrete classroom experiences.

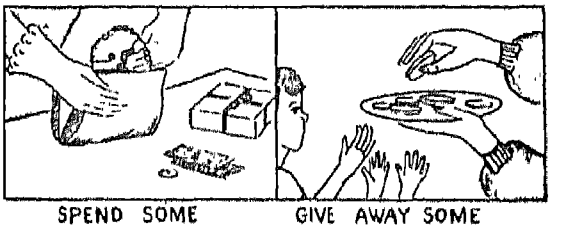
Isolate *from classroom problems* those subtraction facts which correspond to the 36 addition facts whose sums are 7 to 10 (See *Notation and Numeration.*)

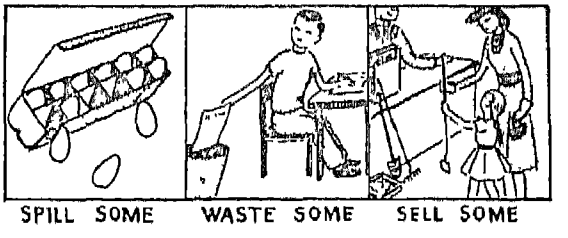
Compare ease and quickness of problem solving with known combinations and those unknown to discover the advantage of being able to give responses to number combinations

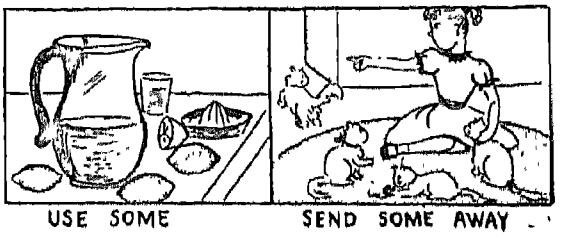
Having Less

The pictures in "Getting More" helped so much in enriching the concept of addition for the children that Miss Martin ventured to use the idea again for









Formulate a program (teacher-pupil planning) for mastery of subtraction facts. (See *Addition of Integers*, for suggestions.)

Provide practice to increase facility of recall and to increase appreciation of the need for knowing subtraction facts and processes. Have pupils use these 36 subtraction facts to solve problems encountered in daily activities, and have them practice these facts in other examples. (See *Subtraction of Integers*, 3B, 2A, 2B, for lists of suggestive activities.)

See that pupils subtract 2-place minuends from 2-place subtrahends including zeros and empty spaces. (Recall similar addition practice.)

Provide problems that require subtracting 3-place minuends and 2-place subtrahends. (See "Do It Our Way.")

Have pupils practice checking. (See Outline, p. *37*.)

$$\begin{array}{r} 65 \\ -23 \\ \hline 42 \end{array} \qquad \begin{array}{l} 12 - 9 = 3 \\ \quad 9 + 3 = 12 \end{array}$$

$$\begin{array}{l} 8 - 3 = 5 \\ \quad 3 + 5 = 8 \end{array}$$

subtraction. This time the children brought some of the pictures and contributed some reasons of their own for having less—reasons that Miss Martin hadn't thought of using. What interesting problems they found in this display!

More Clues

Playing detective is a favorite exercise with Miss Martin's 3B's. Since they had used the exercise in addition, all they needed to know was what kind of detective they would be in subtraction. When they found out that the thing they were looking for in subtraction was called either the *remainder* or the *difference*, they wanted to go "clue hunting" right away.

Whenever the children play detective, Miss Martin reads them some problems and they list the clues they find on the board:

How many *are left*?
How many does Mary *still have*?
How many *remain* in the basket?
How many did John *have left*?
How much change did Jack *get back*?
Find the *difference* in their height.
Twenty-one is how many *less* than twenty-three?

It Helps to Know

"Our team won, Miss Martin," exclaimed Joe as the group came in from physical education.

"Not by very much, though," said Billy. "Only 5 points. We had 7, and you had 11."

"Are you sure about that 5 points, Billy?" asked Miss Martin. "Maybe your team didn't get beaten as badly as you think."

Then she steered the group into determining by subtraction the exact difference in the number of points scored by the two teams. Joe recorded the score for his team on the board, and Billy put the score for his team beneath it and subtracted.

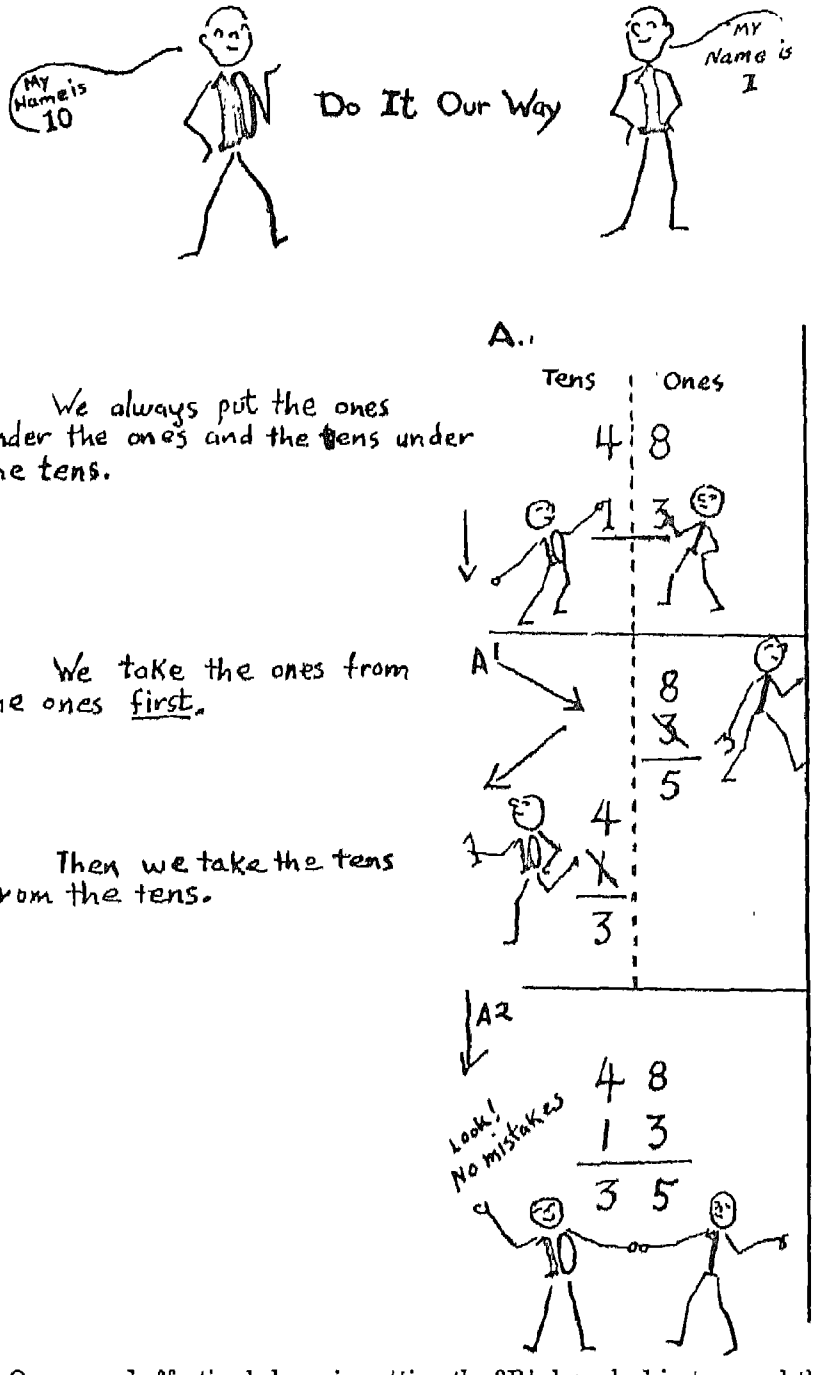
$$\begin{array}{r} 11 \\ -\ 7 \\ \hline 5 \end{array}$$

Billy's remainder was immediately challenged; so out came the markers. When Billy had to change his remainder to 4, he was somewhat chagrined to have counted his team down one point too many.

But Miss Martin was very matter-of-fact and cheerful about the situation and explained, "You just didn't know 11 minus 7, Billy. Let's suppose the score were 8 minus 4, or 7 minus 2, or 6 minus 3. What would the difference be in each case?"

Billy put the remainders down in a matter of seconds. "It's easy when we know the facts, isn't it, Billy?" said Miss Martin. "And look! You did three examples in less time than it took us all to do one. We'll soon know all our facts, and then we can do all our problems quickly and correctly."

With a few more instances like this one, Miss Martin hopes to point up the idea that knowing number facts meets a real need.



Mr. Ten and Mr. One proved effective helpers in getting the 3B's launched in two- and three-place subtraction. Miss Martin was fortunate in having a third grade pupil who could reproduce these stick figures on a poster-size chart. Sometimes she would call upon an older art pupil to sketch figures or pictures.

Continue to promote skills in subtraction facts corresponding to the addition facts whose sums are 11 to 14. (See *Notation and Numeration.*)

Have pupils use these facts as problem-solving skills in quantitative situations in the classroom. Check results. (See Mathematics Program, First Six Weeks.)

Subtraction Seat Practice

The arithmetic file (see *Addition of Integers*) in Miss Martin's room contains several devices for practice in subtraction which are used by the group at a specified time and also by individual pupils for self-improvement at odd moments during the day. Two favorites in the file were described in this way:

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils practice to increase facility of recall. (See "Subtraction Seat Practice.")

Use drill to insure retention and automatic response, using fact cards, flash cards, and games. (See *Addition of Integers.*)

Have pupils practice these facts in exercises and examples.

Check frequently on individual and group progress, using the following devices:

"Quiz Quickie" on facts currently studied

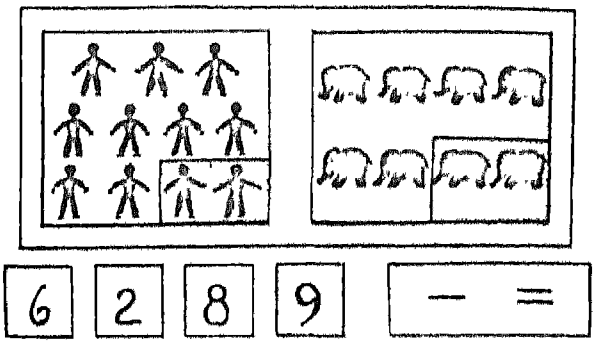
Oral tests for speed and accuracy

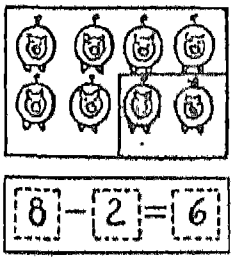
Help pupils to complete the 100 subtraction facts by learning the 10 facts corresponding to the 10 addition facts whose sums are 15 to 18. (See *Notation and Numeration.*)

Continue with practice and drill until complete mastery is attained.

—1—

Materials: Picture, number and symbol cards as shown below:

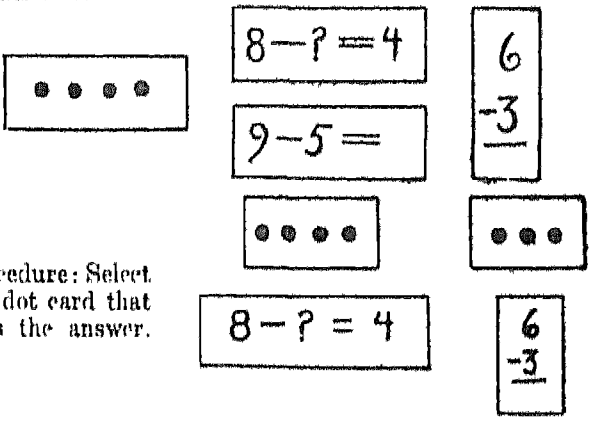




Procedure: Reproduce the pictured fact with numbers and symbols.

—2—

Materials: Dot cards and combination cards as shown below:



Procedure: Select the dot card that tells the answer.

A Survey Test on Concepts and Skills in Subtraction

Find the remainders. Check all answers.

12	7	12	14	8	9	13	11	15
—7	—4	—9	—5	—2	—6	—9	—8	—1
12	17	16	11	8	18	17	16	15
—3	—8	—4	—1	—7	—9	—9	—7	—8
124	54	109	134	55	63	50	118	95
—84	—54	—32	—80	—30	—11	—30	—28	—45

108	113	106
—33	—13	—21

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Write the answers.

	Tens	Ones		Tens	Ones
85 =	.....	.....	63 =	.....	.....
72 =	.....	.....	99 =	.....	.....
109 =	.....	.....	120 =	.....	.....

Copy these numbers. Find the remainders. Check all answers.

62 from 72 32 from 98 55 from 65
67 from 98 25 from 77 23 from 43

32 is how many less than 34?
20 is how many less than 21?
50 is how many less than 55?

12 take away 9 is how many?
18 take away 5 is how many?
67 take away 32 is how many?

Do what the sign says. Check all answers.

12 — 2 = ...
14 + 3 = ...

16 — 5 = ... 18 + 1 = ...
10 — 7 = ... 15 — 3 = ...

Supply the missing number.

16	12	11	15
?	?	?	?
—	—	—	—
8	6	7	12

Objective: To enrich the child's quantitative experiences and extend skills in measurement.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Help pupils to discover new social uses for skills in measuring time:

Taking timed tests

Having quiz program with timed answers (as activity in any subject field)

Computing minutes allowed for completing a unit of work or for cleaning up

Watching for parking signs to help Daddy or Mother

Knowing when it is bus time

Working by a schedule (daily schedule of activities)

Knowing when it is time for a certain radio program

Playing games limited to a specified time interval

Help pupils to discover a need for telling time by the quarter hour:

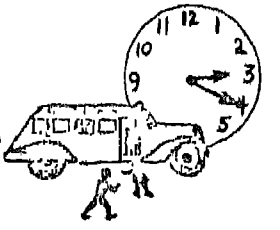
Noticing time items on the daily schedule that require special attention:

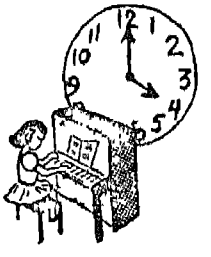
Music	11:15 a.m.
Gym	2:15 p.m.
Art	2:45 p.m.
Dismissal	3:15 p.m.

Let the Clock Help

Miss Baird uses the clock and a clock face together in utilizing a variety of experiences involving time. Her pupils have learned, for example, that they can estimate their progress in an activity by noting occasionally how near the real clock is approaching the time indicated on the clock face, so that they will not spend too much time on any one item.

When several pupils who rode the 3:20 bus missed it occasionally, a poster reminding them of the time it was due was made and hung by the cloakroom door. This gave the children the idea of making personal time reminders.





Mary made a time reminder to help her remember her piano practice.

SUGGESTIVE ACTIVITIES

Discussing the responsibility for promptness when others are concerned, such as special teachers (art, music, gym), nurse, doctor, custodians

Observing that being able to tell time by shorter periods helps one to be more prompt and dependable

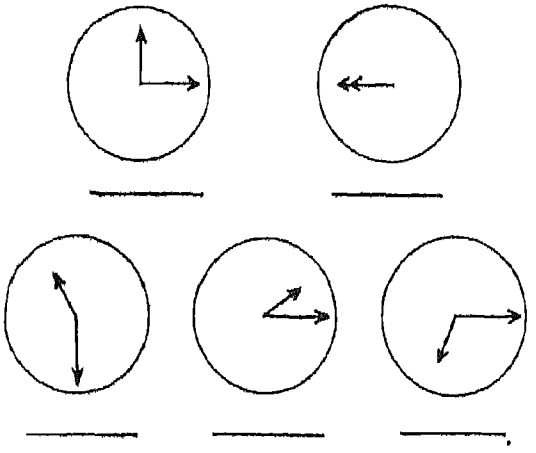
Have children do the following:

Learn to tell time by the quarter hour (See "Learning Quarter Hours")

Practice reading time by the quarter hour

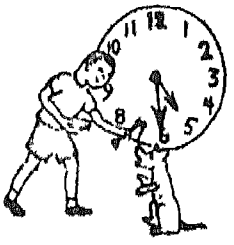
Practice setting the clock to show the quarter hours

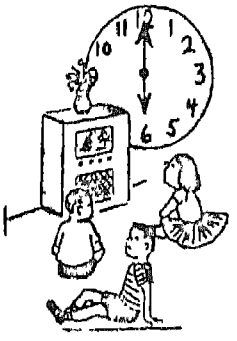
Practice writing the time by the quarter hour, as in the example below:



HOW SOME TEACHERS DO IT

Bill made a time reminder to help him start his chores in time to finish before dinner.

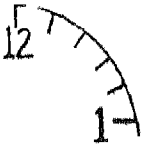




Several children made time reminders of favorite radio programs.

Learning Quarter Hours

Moving the hands on the clock face to show hours and half hours and counting by 5's round the clock (see 1A) were familiar activites in Miss Baird's room. But there were some things about the clock yet to be learned.



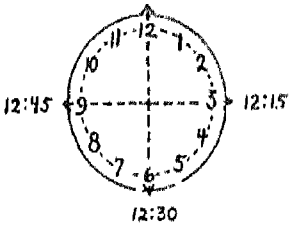
One day Miss Baird made a drawing on the board that showed a five minute interval on a clock. "How many spaces are there between the twelve and the one?" she asked.

Checking with the pointer, Miss Baird verified Billy's answer of "five." Then, showing the class a clock face, she further noted that there were five spaces between all numbers.

"That's why we can count by 5's round the clock," said Miss Baird, and she proceeded with a few clear, simple steps to explain telling time by quarter hours.

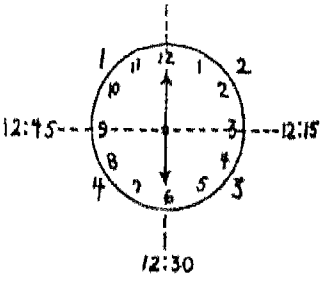
1. She drew a clock face on the board.

2. She moved an imaginary minute hand around the clock, counting by 5's and pausing at 3, at 6, and at 9 to write the time.



3. She read the quarter hours again: "Twelve-fifteen, twelve-thirty, twelve forty-five."

4. She retraced the four stopping places of the minute hand and noted that the clock face is marked off into four equal parts. She recalled to the children's minds that a *fourth* is a *quarter* and concluded that 15 minutes is a quarter hour. She then read again: "Twelve-fifteen, twelve-thirty, twelve forty-five."



SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend knowledge of the six familiar coins in our monetary system.

Review coins and equivalents of coins. (See 2A, and 2B.)

Identify coins brought in for various purposes:

dollar	quarter	nickel
half dollar	dime	penny

"Pair up" equivalent coins:

dollar—
- 2 half dollars
- 4 quarters
- 10 dimes
- 20 nickels
- 100 pennies

Increase the ability of pupils to make change.

Review making change. (See 2A.) Continue to have pupils make change, as the storekeeper does, in classroom situations:

Paying for lunch
Paying for milk
Playing store
Playing cafeteria (See "Playing Cafeteria")
Selling tickets for school movie

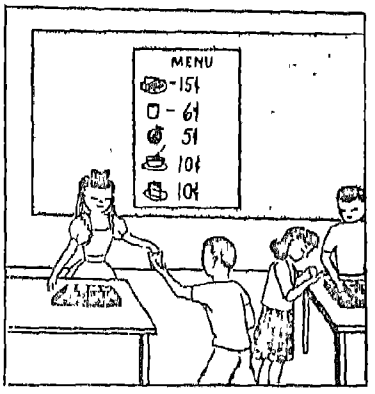
Review making change for 20c and 25c, using classroom situations for practice. Vary amounts spent, as follows:

below 5c 6c-9c 11c-14c 15c 16c-19c 20c 21c-25c	Have child count by pennies to nearest multiple of five and then by nickels and (or) dimes to amount received.

Continue with daily calendar work. (See 2A, and 2B.)

Playing Cafeteria

The 3B's in Miss Mier's room do not have access to a cafeteria, and so they do the next best thing; they play cafeteria in connection with their health unit and find an excellent opportunity to use their knowledge of making change.



Each child is given a specified amount of play money — some days 35c, some days 50c, some days even a dollar. He is given a sales slip also. In full view of the group is a large picture menu, with prices marked at the side of each article. A cashier is stationed at the front of each row with a change box.

Self-service includes selecting a meal from the menu, making out the check, presenting it to the cashier, paying for it, and checking the change if there is any change coming.

Only qualified pupils who can consistently make correct change in this manner may be cashiers:

1. Check the check slip for correctness

2. Count by pennies (or nickels) to the nearest multiple of five

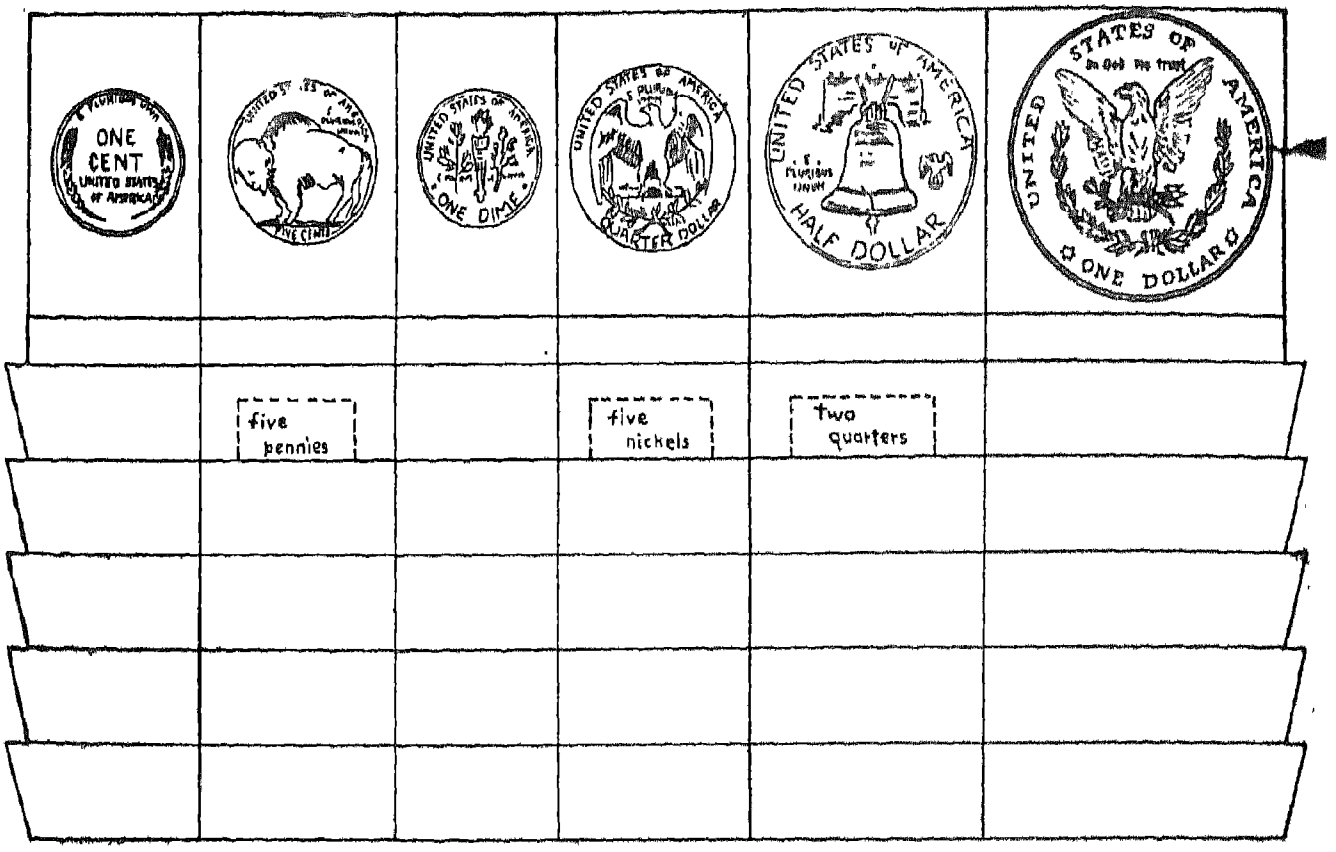
3. Count on to amount received

Example:
If amount received is a quarter and a dime and the amount of the check is 31c, the cashier counts by pennies to 35.

If amount received is 50c and the amount spent is 31c, the cashier counts by pennies to 35, by a nickel to 40, and by a dime to 50.

If amount received is $1.00 and the amount spent is also 31c, the cashier counts by pennies to 35, by a nickel to 40, by a dime to 50, and by a half dollar to a dollar.

A Chart of Equivalents



five pennies	one cent	two nickels	twenty-five pennies	fifty pennies	ten pennies	ten nickels
a nickel and five pennies	two dimes and five pennies	a quarter and five pennies	two quarters and five dimes	twenty nickels	two quarters and one half dollar	one hundred pennies

A picture of the six coins pinned to the top of the pocket chart and a set of cards like those shown provide interesting drill material for coins and their equivalents. Miss Blayne follows such drill by giving out sheets with duplicated pictures of coins.

She uses similar drill material for equivalents in linear and liquid measurements.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend pupils' knowledge of linear measure by demonstrating the need for standard units of measure and how to use them. Activities for pupils might include the following:

Keeping a progressive height record

Recording readings of stadiometer from one measuring to the next

Measuring with ruler, yardstick, or tape measure and interpreting measurement by means of markings on the measuring unit (Pupils might measure paper for valentines, Christmas cards, book covers, a frieze or

Why We Need Measuring Tools

The 3B's were making book covers. The cover Miss Blayne showed them was very neat, and everyone wanted his to be, too.

"Will you measure my book, Billy, so that the children may make theirs the same size?" asked Miss Blayne.

Billy measured and wrote on the board, "8 inches wide, 11 inches long."

The class decided that a foot ruler was the best tool for measuring their book covers.

other construction work, material needed for costumes or scenery.)

Measuring to decide whether or not a cage or a box will fit into a certain space

Discuss measuring in various situations. (See "Why We Need Measuring Tools.")

Extend concept and uses of pound, half-pound, and ounce.

Encourage children to *observe* the following in the study of a grocery store:

Relative size and weight of canned goods
large can of juice—46 ounces (2 lbs., 14 ounces)
small can of orange juice—4 ounces

Relative size of pound and half-pound
butter, flour, tea, coffee, sugar, fruits, vegetables

Relative size of half-pound and quarter-pound
butter, fruits, vegetables, tea, pepper, spices

Items we buy by the ounce most often
pepper, spices, tea, extracts

Have children "heft" articles to estimate weights and then compare them with actual weights.

Encourage children to observe the following in the study of communication or transportation:

Weights of letters (extra postage requirements)

Weight limitations on packages

Weight allowance on airplanes

Weight allowance on bridges and elevators (casual reference to tons)

Have children estimate weight of paper brought in for paper drive.

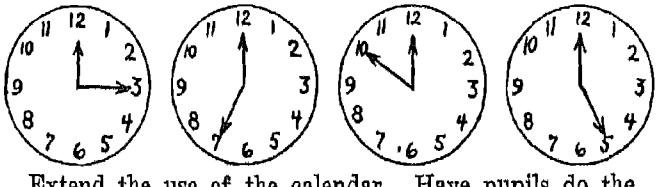
Extend skill in telling time by five-minute intervals. Have children do the following:

Recall counting by 5's to arrive at 12:15, 12:30, 12:45 (See "Learning Quarter Hours.")

Note that when we stop the minute hand at 1, we have gone 5 minutes past the hour and that the time is 12:05, or twelve five o'clock

Practice telling time by five-minute intervals:
12:10, twelve ten o'clock
12:35, twelve thirty-five o'clock
12:50, twelve fifty o'clock

Count by 5's from 12 to the minute hand on these clock faces and write the time for each:



Extend the use of the calendar. Have pupils do the following:

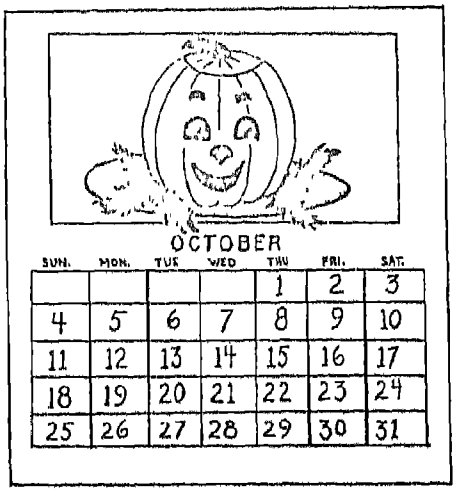
Curtains were needed for the puppet stage set. The set was measured with a yardstick. It was 38 inches wide and 24 inches high. The children decided that they would need two pieces of material, each 45 inches wide and 28 inches long. They measured the material with a tape measure so that it would be just right.

Papers 8 inches square were needed to make pin wheels. With a ruler the 3B's were able to make the pieces exactly square.

The class had a cookie sale. Billy brought his mother's kitchen scales to weigh the cookies. Jane found that in the pound of cookies she weighed there were 16 cookies. Miss Blayne said, "Each cookie weighs about 1 ounce, for there are 16 ounces in a pound." Scales helped to give everyone the same amount for his money.

The Christmas party was scheduled for December 23 On December 12 the children wondered how many more days they had left to get ready for it. The calendar told them they had 11 days. A calendar is a convenient unit for measuring time.

Days, Weeks, and Months



OCTOBER

SUN.	MON.	TUE	WED	THU	FRI.	SAT.
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

(Use current month.)

Find the first day of October on the calendar. On what day does October begin?

How many Sundays are there in October?

How many Saturdays are there in October?

Read the dates for all the Fridays in October.

How many school days are in the first week of October?

On what *day* will November 1 come?

On what *date* will October end?

Is October a short or a long month?

Does any month in the year have more days than October?

Study the current months to associate days, weeks, months, and dates with the calendar (See "Days, Weeks, and Months.")

Review months of the year (See 2A.)

Continue to use calendar for birthdays, holidays, seasons, current date, and special dates such as the paper drive

Make individual desk calendars for personal use (These may be scotch-taped to underside of desk top.)

Mark birthdays of close friends on individual calendars

Extend use of liquid measurement

Review liquid measurement, 2A and 2B.

Help pupils discover new equivalents in liquid measures. Activities might include the following:

Filling four quart jars with paste from a gallon jar of paste, to share with three other rooms

Filling two pint jars with paste from one quart jar so that paste will be available to two groups at one time

Estimating how much milk (or water) each child drinks per day (See "Surely Not Gallons!")

Reporting experiences in marking daily milk orders (See "Ready for the Milkman.")

Recording the number of half-pints of paint the art department donated for painting the movie theater, how much was used (as 3 half-pints, or 1 pint and ½ pint), and how much was returned

Discovering through store activities how these articles are usually sold:

milk, vinegar, gasoline, paint, honey, kerosene, syrup, ice cream, turpentine

Using the empty paste jar to bring a gallon of water at a time for the aquarium

Extend understandings of the concept of temperature and ways of measuring it.

Explain meaning of room temperature.

Have pupils do the following:

Use home appliances to get temperatures for various situations:

oven stove furnace heater	to increase temperature
refrigerator deep freeze air conditioner fan	to decrease temperature

Name the first and the last day of a regular week

Name the first and the last day of a school week.

On what days do these dates come: October 16, October 24, October 31?

How many Mondays are there in October?

What days come only four times in October?

What days come five times in October?

Surely Not Gallons!

"I drink about five gallons of milk every day," boasted Donnie during morning milk lunch.

"You surely don't mean gallons, Donnie," said Miss Moffet. "Five gallons would be our big gallon paste jar full 5 times. I doubt if anyone would want to drink that much of anything in one day. But I'm glad you drink a lot of milk. I wonder about how much you really do drink."

This seemed an excellent time to consider measurements in arithmetic, and Miss Moffet was glad she was ready with various measuring units on hand. The half-pint milk cartons had been put back in the milk carrier after the milk lunch. Quart, pint, and gallon measuring units were brought out of the cupboard.

When Donnie saw that he would have to drink 16 half-pint cartons of milk to make 1 gallon, he decided he couldn't drink even that much in a day. Five rows of 16 chalk marks each showed him he would have to drink 80 cartons of milk to make 5 gallons. Donnie groaned, "Oh my, I'd hate to *have* to drink 5 gallons of milk in a day."

Experimenting further, the class decided that most of them didn't drink even a quart (4 glasses, 4 half-pints) of milk. Most of their families consumed only 2 or 3 quarts a day. They thought keeping account of the amount of milk their families used in one week would be interesting.

The day after Donnie's experiment, he reported to the class that he had marked the milk card for his mother that morning and that he had ordered 2 quarts of milk, 1 quart of chocolate milk, and ½ pint of coffee cream. There are five in Donnie's family; so no one person in the family would have a whole quart.

Donnie's report gave ideas to the other children, and the next day there were several such reports. Miss Moffet had a surprise for them: mimeographed copies of milk order cards for them to practice marking.

They noticed that milk, chocolate milk, orange juice, and buttermilk are sold in quarts; half-and-half cream and cottage cheese in pints; and coffee cream and whipping cream in half-pints. They decided that a practical order would be one that could be used without waste, that is, it could be used before it spoiled. Each child tried to make his order practical for his family.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Use thermometers to determine amount of increases and decreases of temperature

oven thermometer

wall thermometer

thermostat

clinical thermometer (See "A Visit from the Nurse.")

Recognize certain common temperatures

Room—68° to 70°

Body—98.6° (usually)

Boiling water—212° Fahrenheit at sea level

Freezing water—32° Fahrenheit

Extend understanding and use of dozen, pair, and cups.

Have pupils continue to use these measurements in classroom activities, such as playing store and measuring ingredients

Continue experiences with money, such as making change, adding, and subtracting, in activities that offer such opportunities.

Develop understandings of the postage stamps we commonly use:

Appearance and uses of 1c stamp, 3c stamp, and 6c stamp

What a stamp does:

Pays for workers needed to handle and transport mail (postmaster, postal clerks, truck drivers, truck mechanics, airplane workers, baggage car workers, mailmen)

Pays for train, bus, and airway transportation

Make such holidays as Christmas, Valentine's Day, Easter, and Mother's Day occasions for buying and using stamps.

A Visit from the Nurse

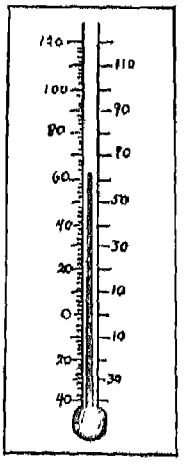
"The nurse says I have a fever, and she is taking me home," said Susan when she returned from seeing the nurse about her headache.

"She must be sick," said Mary. "When I had a fever, I was very sick."

"Having a fever doesn't always mean that we are quite ill," said Miss Swanson. "When the nurse returns, perhaps she will explain to us about fever and how we can tell whether or not we have any."

The nurse did explain. She also explained what most people's body temperature is when they are not feverish (98.6°), how we can tell by a clinical thermometer just what our body temperature is, and how a clinical thermometer differs from a wall thermometer and thermostat.

Reading a Wall Thermometer

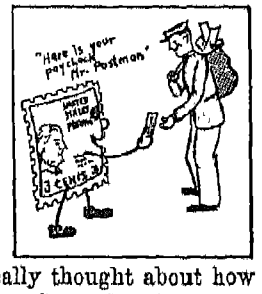


Miss Swanson followed up the nurse's visit with further work on thermometers. She made a large drawing of a Fahrenheit thermometer, with markings plainly visible. For some time she would write the thermometer reading on the board and then let a child show it on the paper thermometer by extending a red string from the bottom and pinning it at the proper marking.

Sometimes when the temperature outside was startlingly varied, it was recorded rather than the room temperature. Often the children would report such temperatures heard on the weather report over the radio. Before long they were alert to temperatures and thermometer recordings, and some few became skillful at reading the thermometer.

Stamps On the Job

When Miss Garth's 3B's visited the post office during a social studies unit, they were surprised by all they saw going on and by what their guide and Miss Garth told them.



Bobby's father is a mail carrier, but Bobby had never seen how his father got the mail he delivered. He hadn't known before that Daddy's paycheck came from the money people paid for stamps.

None of the children had really thought about how important stamps were. So Miss Garth let them talk and talk about all the workers and the bus, airplane, and train transportation that were paid for by the sale of postage stamps.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

They decided that since stamps were so important, they would make pictures showing what they did. These they put in a book, which they called "Stamps On the Job."

Post Office Know-How

The 3B's found that running their play post office involved more than just buying a play stamp and pasting it on a letter. They had to know what kind of stamp to buy for the piece of mail they were sending. They had to add the cost of the stamps they bought so that they would know if the postal clerk had asked for the right amount. They had to select the right coins from their play money to pay for them. If there was change coming, they had to be able to check it as the postal clerk counted it out to them.

"It's a good thing we can add and subtract and make change," said Donnie wisely. "We wouldn't be good postal clerks or good customers if we couldn't."

Objective: To see that pupils continue to use ½, ¼, and ⅓ and to help them gain a concept of ¾ of a whole or a group.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

ALL SEMESTER

Review *Fractions*, 2B, 2A.

Have pupils continue to use one-half and one-fourth in classroom activities. (See *Measurement*, 3B.)

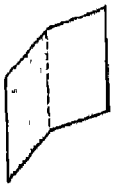
Have pupils cut or fold papers for classroom activities:

Seatwork

300	301	302
420	421	422

Spelling	
1.	8.
2.	9.
3.	10.

Covers for books



Half circle for designs

Fourth circles colored for designs

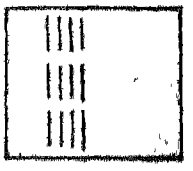
Suggest that pupils arrange a given number of figures in groups for design. such as 12 rabbit cutouts grouped in halves, in fourths, in thirds, or separated so that ¼ of them appear at the top and ¾ at the bottom.

Separate a dozen eggs, which are to be colored for Easter, into fourths or thirds. (See "Easter Eggs.")

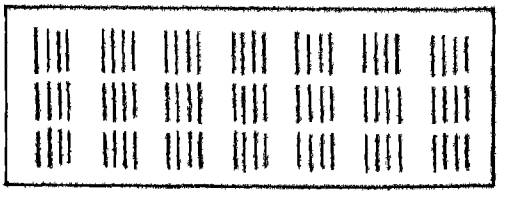
Easter Eggs

The third graders in Miss Boyle's room had each brought several boiled eggs for dyeing and had stored them in empty egg cartons. When it was time to dye them, they found that they had 7 full cartons of eggs. There were 28 pupils to dye them. Miss Boyle immediately saw possibilities for use of fractions. "We'll have to find out how many eggs each pupil may dye," she said. "I wonder how many eggs we have all together."

"Here's a picture of one carton," she said as she put on the board a chalk mark for each egg:



"Seven cartons will look like this:"



"Now count the top row of marks, Susan," she said. Susan counted and reported that there were 28. Miss Boyle looked wise and remarked, "I wonder who is thinking what I'm thinking."

Bill's hand was the first up. "Each of us may have three eggs out of seven cartons."

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

"Good," said Miss Boyle. "Now let's help our monitors a little. How many children can be served from one carton of eggs?"

"Four," promptly replied Bill.

"How did you decide that, Bill?"

"There are four rows with three eggs in each row. So four children can be served."

"And each child will get one fourth of one carton," said Miss Boyle.

Objective: To teach children to use the decimal as a cents point in problems involving money.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

This work is fully developed in *Notation and Numeration*, 3B.

Objective: To extend ability to use arithmetic skills in problem-solving situations.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Encourage pupils to use new arithmetic knowledge and skills learned in the first six weeks in solving problems occurring in such activities as the following. (See *Addition of Integers*, 3B, and *Subtraction of Integers*, 3B, for other suggestions.)

Playing and scoring games (See "Ring Toss" and "Ring Toss Problems.")

Holding a sale

Baking cookies for a sale: measuring, counting, grouping, adding, subtracting

Finding profit from a sale

Planning to entertain another group

Playing store: adding cost of purchases (through 3 addends), making change, comparing prices of two articles

Giving a show

Using materials

Finding gain or loss in weight

Keeping weather records

Finding differences in scores

Making gifts

Ordering seeds for the school garden

Ring Toss

Ring Toss is a familiar game to Mrs. Bower's 3B group. But Mrs. Bower carefully plans for them to find more in a game of Ring Toss this year than they did in first and second grade, because they have more knowledge and more skills to put into a game.

Today the ring toss boards had the numbers 1 through 5 on them, so that no combination of numbers ringed could equal a sum beyond ten. Three teams played. Each player had two tosses. A scorekeeper for each team recorded scores on the board:

Team 1		Team 2		Team 3	
Tom	5 4	Bob	2 5	Sandra	0 5
Sue	0 3	Mike	3 4	Bill	5 2
Joe	5 5	Ann	2 0	Carol	5 3

When the game was finished, two questions were asked immediately: "Who has the most points?" and "Which team won?" Mrs. Bower suggested that each player add his own score on the board so that the whole group could check it and see who had the highest score.

Tom	Susan	Joe	Bob	Mike	Ann
5	0	5	2	3	2
+ 4	+ 3	+ 5	+ 5	+ 4	+ 0
9	3	10	7	7	2

Sandra	Bill	Carol
0	5	5
+ 5	+ 2	+ 3
5	7	8

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Continue to encourage children to solve problems necessary for carrying on the activities in the classroom.

Extend use of combinations in such problems to include those newly developed. (See *Addition of Integers*, 2B, *and Subtraction of Integers*, 3B.)

Include problems involving measurements, making change, calendar, and ordinals.

Continue as in first and second six weeks to have pupils solve problems peculiar to the current activities in the classroom.

Extend use of combinations in such problems to include combinations newly developed.

Each scorekeeper then went to the board to find the score for his team.

Mrs. Bower helped each one do it in this way:

Team 1

First toss	Second toss	Both tosses	
5	4		
0	3	10	
5	5	12	
10	12	22	Total Score

Team 2

2	5		
3	4	7	
2	0	9	
7	9	16	Total Score

Team 3

0	5		
5	2	10	
5	3	10	
10	10	20	Total Score

They had no more time for the arithmetic period, but Mrs. Bower suggested that they leave the record of the game on the board.

"I'd like to know some more things about these scores," she said. Perhaps there are other things you'd like to know, too. Tomorrow we'll have time to think about them again."

Ring Toss Problems

The next morning the record of the Ring Toss game was on the board in a slightly different arrangement:

	First Toss	Second Toss	Total
Tom	5	4	
Susan	0	3	
Joe	5	5	
Bob	2	5	
Mike	3	4	
Ann	2	0	
Sandra	0	5	
Bill	5	2	
Carol	5	3	
Team 1	10	12	22
Team 2	7	9	16
Team 3	10	10	20

On the board Mrs. Bower wrote, "Ann's score in Ring Toss was 2. Susan's score was 3. How many points did both girls have?"

That was so easy that every hand was up, and the answer was almost spontaneous. When Mrs. Bower asked them how they got the number 5, Tom answered, "Two and three are five."

"Why didn't you say, 'Three take away two leaves one'?" asked Mrs. Bower.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

"Because *both* means Ann and Susan *together,* and that is a clue to adding.'

"I can make a problem with a clue to subtraction," said Bill. Several others were sure that they could, too. Mrs. Bower suggested that they take some time to think of things they would like to know about the scores on the board and then put them into problems for the class to solve. After the problems were stated orally and accepted by the class as being something interesting and worth while to solve, Mrs. Bower wrote them on the board for the children to solve on paper.

"Remember," she warned, "I always want to know what you're adding or subtracting and what your answer is. Don't forget to give your answer a name."

7 points
2 points
—
9 points

The following problems were selected by the class:

1. Tom scored 5 points and 4 points in Ring Toss. How many points did he have *in all?*
2. Sandra scored 5 points, Bill 7 points, and Jim 8 points. How many points *more than* Sandra did Jim score?
3. Team 1 scored 10 points on the first toss, and Team 2 scored 7 points on the first toss. How many points did *both* teams have on the first toss?
4. Tom scored 9 points in Ring Toss, and Joe scored 10 points. Joe scored how many *more* points than Tom?
5. Susan scored 3 points, Sandra scored 5 points, and Ann scored 2 points in Ring Toss. How many points did the girls have *all together?*
6. Team 1 had a total score of 22 points, Team 2 had a total score of 16 points, and Team 3 had a total score of 20 points. What was the *difference* between the scores of Team 3 and Team 1?
7. Susan's score in Ring Toss was 3, and Sandra's was 5. How much *less than* Sandra's score was Susan's score?

Objective: To extend the use of the vocabulary developed at the earlier levels and to understand and use the words needed at this level.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Use opportunities which arise frequently in the course of daily activities to develop and enrich a meaningful arithmetic vocabulary.

Use the correct word at all times.

Use correct symbols at all times.

Observe whether pupils use arithmetical terms and symbols correctly.

Check with the Mathematics Program, pages 40, 25, 13, 12. for words children should be using at this level.

Objective: To extend skill in reading and writing numbers and to extend the concept of the value of numbers.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have children do the following:

Continue to read telephone numbers

2809: two, eight, oh, nine

Use a four-figure number in the other situations

Cost of new car in Donnie's family, $2,895: two thousand, eight hundred ninety-five dollars

Total number of children in the school, 1335: one thousand, three hundred thirty-five

Observe that four-place figures are used often

Dates—February 3, 1952

House numbers—3245 Maple St.

Telephone numbers—Dexter 4135

Notice how dates and house numbers are read

1952: nineteen fifty-two

3245 Maple St.: thirty-two forty-five Maple Street

1401 Race St.: fourteen, oh, one Race Street

Practice reading each of these numbers in three ways:

1863	1925	1361	1708	2005
1405	1542	1244	1355	2165

1756: one thousand, seven hundred fifty-six
one, seven, five, six
seventeen, fifty-six

Write these numbers in figures:

Two thousand

One hundred fifty-five

Twelve hundred five

Fourteen hundred ten

Fourteen hundred six

Recall to children the meaning of four-figure numbers. (See *Notation and Numeration*, 3B.)

Review pupils on the reading and writing of dollars and cents (See "Pointing Up a Technique.")

Help pupils to do the following:

Recall knowledge of Roman numerals learned at earlier levels (See 2B, 2A.)

Discover what figures the letters stand for.

I is 1

V is 5

X is 10

Something New

When the children in Mrs. Holt's room were listing their telephone numbers on the board, Patty's looked different from the others. She had written, "BE 2-4055."

"I've never seen a number like that," said Bill. "How do you read that?"

"Patty can probably read it for us," said Mrs. Holt.

Patty took the pointer that Mrs. Holt offered her and read, "Belmont, two, four, oh, five, five."

"Perhaps you will tell us why you have a number like that," suggested Mrs. Holt.

Patty explained that she was staying with her grandmother while her mother and daddy were gone. Her grandmother lived in Lakewood and had a Lakewood number.

"My aunt lives in Englewood, and her number is Sunset 1-3567," said Carol.

"We would write that, 'SU 1-3567,'" said Mrs. Holt. "Perhaps we need to know how to read and write telephone numbers of neighboring cities."

They made a survey of the room to find out how many pupils had relatives or friends in Aurora, Lakewood, Englewood, and Arvada. They decided that there were enough to justify spending some time on listing and reading phone numbers from those exchanges.

Can You Read Price Marks?

On a tour of the neighborhood department store, Miss Lane's 3A's were delighted that they could read price marks. When they got back to their room, they listed on the board the prices of items they were especially interested in, such as blue jeans, $2.98; cowboy shorts, $1.98; girls' purses, $.98; shoes, $4.98; handkerchiefs, $.25; half-socks, $.59; toy airplanes, $2.00; scooter-bikes, $10.95.

"You remember how to write price marks, too," remarked Miss Lane. "I'm pleased about that."

When Letters Are Numbers

"When letters are numbers, reading and writing them is just like working out a puzzle or using a code," said Miss Bauer to her 3A's.

All the children knew about puzzles, and many of them had secret codes. Miss Bauer explained that the only secret about Roman numerals was learning what the letters meant and how they were used. Then anyone could interpret a Roman numeral message.

She went to the board and wrote, "Mary's birthday is February XVI. She will be IX years old. She is IV years older than her small brother."

SUGGESTIVE ACTIVITIES

Discover that when I comes before a letter of greater value it is to be subtracted:

V is 5
IV is 4 — 4 is 1 less than 5

X is 10
IX is 9 — 9 is 1 less than 10

Discover that when I comes after a letter of greater value it is to be added:

V is 5
VI is 6 — 6 is 1 more than 5

X is 10
XI is 11 — 11 is 1 more than 10

VII is 7
VIII is 8 — (See "When Letters Are Numbers.")
XII is 12

Discover that with this understanding they can make other numbers:

X is 10
III is 3 — 13 is 3 more than 10
XIII is 13

X is 10
VIII is 8 — 18 is 8 more than 10
XVIII is 18

Build numbers through XX

Read chapter numbers written in Roman numerals in table of contents of available books.

Give children practice in reading and writing Roman numerals. Use short oral and written exercises. (See "Can You Do It?")

Have children practice the correct way of writing dollars and cents, using the multiplication facts of 2's as they are developed:

2c	$.02	$.09	9c	14c	$.14
2	2	2	2	2	2
4c	$.04	$.18	18c	28c	$.28

Continue to stress the correct way of writing dollars and cents as the multiplication facts of 3 are developed:

13c	$1.13
3	3
39c	$3.39

Extend the meaning of value of numbers above 2000. (See "Breaking Numbers Into Parts.")

HOW SOME TEACHERS DO IT

Miss Bauer was delighted with the interest and enthusiasm the children showed. They used Roman numerals in several stories before they discovered that Miss Bauer was absolutely right! If you know what the letters mean, you can write any number message in Roman numerals.

Can YOU Do It?

The boys in Miss Bauer's third grade were in the epidemic stage of "challenging" one another to do physical feats. She began challenging them to put a little extra push into accomplishing mental feats as well as physical. The children liked the idea. They agreed that a Can-You-Do-It Center would be interesting. From time to time, children found in the Center things to do that required a knowledge of Roman numerals:

Can *you* write 13, 15, 19, 18, 20 as Roman numerals? Can *you* write IX, XI, XIV, XIX, and XX as Arabic numbers? Can *you* write from 1 to 20 in Roman numerals? Can *you* write 9 o'clock, 12 o'clock, and 7 o'clock as Roman numerals? Can *you* arrange these Roman numerals in order from the lowest to the highest: IV, III, IX, VI, VII? Can *you* match these Roman numerals with the Arabic numbers for which they stand:

8	IX	19	XII
9	VIII	20	XIX
12	XX		

Miss Bauer was always careful to comment on the fine work turned in from the Can-You-Do-It Center and never allowed a day to pass without putting some work there that required a little extra effort or skill.

Breaking Numbers Into Parts

A whole truck load of coal was being delivered to the school just as the 3A's went out for recess.

"That's sure a big load of coal," said Billy to the driver, who was removing the end gate.

"Yes, sonny," answered the driver, "that's 7356 pounds of coal, according to this ticket."

"Seven thousand, three hundred, fifty-six," repeated Billy. He liked big numbers. He liked to have special information to give to the class, too; so when they were all back in their seats after recess, Billy said, "I know how much coal was on that truck: 7356 pounds."

"That *is* a lot of coal," said Billy's teacher. She wrote it on the board because she needed a big number for that day's arithmetic lesson.

Suggestive Activities	How Some Teachers Do It
Extend the concept of regrouping to 3-place numbers Use counters and pocket chart to show regrouping and changing of place values of a number 258 is	A Good Paper Drive When Miss Clark was ready to develop regrouping involving changing tens to hundreds and hundreds to tens, the paper drive provided a splendid motivating activity. The first day of the drive only 258 pounds of paper were collected. Every child was urged to work harder for the next day's collection. The pupils though 258 pounds of paper was a lot. Miss Clark wrote the number on the board saying, "Two hundred fifty eight pounds of paper is not enough for a good paper drive. Our room should bring in more than that alone. Let's see just what 258 means." With hundreds-counters, tens-counters, and ones-counters, the pupils and Miss Clark worked out the activities shown in the column opposite.
Chart the findings of the above activity	o o o o o o The next day the girls brought in 185 pounds and the boys 231 pounds. Again, Miss Clark put the numbers on the board and again with counters the regrouping possibilities of each number were explored.
Write out place values 258 is 2 hundreds 5 tens 8 ones 258 is 1 hundred 15 tens 8 ones 258 is 158 ones 258 is 25 tens 8 ones	Only One Ten for Ten Ones Changing tens to hundreds gives only 1 hundred for 10 tens was a concept that needed further consideration. Twelve children brought lunch money on Monday. The total amount of money was $3.75. Miss Clark led the children to explore the possible groupings in $3.75 (See Suggestive Activities on page 110)

Suggestive Activities

Use money to point up that the total value of a number is constant regardless of changes in place values brought about by regrouping

Show that

Twelve lunches at 25¢ each can be paid for with $3.75 in any of these ways.

Dollars	Dimes	Pennies
3	7	5
	37	5
	30	75
		375

Have children think of other groupings of coins that would total $3.75

Use regrouping to solve several 2-place addition problems in which the sum of the ones digits is more than 9

Use regrouping to solve several 3-place problems in which the sum of the digits in tens place is more than 9

616 Miss Clark's room
-509 Miss Brown's room

6 hundreds 1 ten and 6 ones
-5 hundreds 0 ten and 9 ones

Regrouping from tens to ones place is needed in the minuend.

6 hundreds and 0 ten and 16 ones
-5 hundreds and 0 ten and 9 ones
1 hundred and 1 tens and 7 ones

Generalize: When the sum of the digits in tens or ones place is more than 9, it is necessary to regroup.

How Some Teachers Do It

Regrouping in Addition

On the last day of the paper drive the boys brought 98 pounds of paper, the girls 79 pounds. Miss Clark suggested that they find the total for that day. Using tens and ones counters she let the children discover a use for the regrouping they had learned to do. As they worked she recorded their findings on the board.

tens	ones
9	8
+7	9
16	17

tens	ones
16	17 =
17	7 = 177

98
+79 = 9 tens and 8 ones
7 tens and 9 ones
16 tens and 17 ones =

16 tens + 1 ten + 7 ones =

17 tens and 7 ones = 177.

Miss Clark put the total of the girls' collection and total of the boys' collection for the drive on the board. With counters they solved the addition, regrouping tens to hundreds places

2 8 3 pounds (girls)
3 3 3 pounds (boys)
5 11 6
6 1 6 =

Discovering that regrouping is just as effective when subtracting to find differences was the next step, as shown in the opposite column and below:

333 boys
-283 girls

Regrouping is needed from hundreds place to tens place in the minuend.

3 hundreds and 3 tens and 3 ones =

2 hundreds and 13 tens and 3 ones
- 2 hundreds and 8 tens and 3 ones
0 hundreds and 5 tens and 0 ones =
50 pounds difference

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils recall and use, whenever possible, learnings from earlier levels:

Ordinals

Value and meaning of numbers

Reading and writing of numbers

Reading and writing of words *one* to *twenty*

Roman numerals I-XII

During the arithmetic period they broke Billy's number all up into parts and put it together again. They knew all the parts, of course, but Miss Barlow believes it is well to recall such information from time to time

7356 has	7 thousands	7000
	3 hundreds	300
	5 tens	50
	6 ones	6
		7356

"I'm glad I don't have to carry in all that coal," said Bob.

"I could carry the ones' part," said Tom.

"I could carry the tens' part," boasted Jim. "I might even carry the hundreds' part."

Objective: To teach the process of carrying in addition.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Plan to have situations arise that require carrying in addition.

Teach children to add 2-place numbers (2 addends, last sum 9 or less) involving money. 28c
Develop without reference to the text at this stage, using such classroom experiences as the following: 15c
—

Finding cost of materials used in an activity (See "We Learn to Carry.")

Finding cost of articles to fill Red Cross box

Toilet articles	58c
Other articles	36c

Finding amount collected for Red Cross

Boys	48c
Girls	46c

Finding amount of money brought for lunches

Boys	15c
Girls	45c

(Note zero in cents place.)

Have children add 2-place numbers (2 addends, last sum 9 or less) involving persons or things, using such classroom experiences as the following:

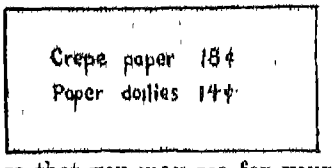
Finding total number of children present (See "Adding the Attendance.")

Finding total number of pages read in two different books or by two children

We Learn to Carry

Purchasing materials to decorate the Valentine box gave Miss Briton a good problem to use in introducing carrying. The class had voted to use some of their money from the cookie sale to pay for the materials. Miss Briton had agreed to get the materials for them. Today she brought the materials and the sales slip, together with a complete plan for using this situation to introduce carrying in addition

Her preparations included enough dimes and pennies in the cash box to develop the process concretely. When it was time for the arithmetic period, she showed the children the materials and the sales slips. She put the items on the board. "I wanted you children to know how much of your money I spent," said Miss Briton; "so I brought some coins today so that you may see for yourselves. You'll notice that the crepe paper cost 18c. How many dimes and pennies will we need to take from the cash box to make 18c? Who would like to do it?"



Carol volunteered. She took 1 dime and 8 pennies from the cash box and stacked them so that everyone might see. Then she told Miss Briton: "Eighteen cents is 1 dime and 8 pennies." Miss Briton wrote her statement on the board.

Jim volunteered to take the 14c for the paper doilies from the cash box. He reported, "Fourteen cents is 1 dime and 4 pennies," and Miss Briton recorded his statement on the board. Then she looked at the two stacks of pennies. "Here we have 8 pennies and 4 pennies in two stacks. If we put them together, how many pennies would we have in one stack?" ($8 + 4 = 12$.)

SUGGESTIVE ACTIVITIES

Finding total number of cookies brought for the cookie sale

Boys	38
Girls	58

Finding total number of boys and girls buying tickets for the school movie

Boys	16
Girls	15

Finding total number of coat hooks in two rows to determine how many coats may be hung there

Hooks in first row	15
Hooks in second row	15

(Note zero in one's place)

Finding total points scored by boys and girls in the paper drive to determine standing of the room

Boys	45 pts.
Girls	27 pts.

(1 point for every 25 pounds of paper)

Have pupils do the following:

Practice extensively the two types of carrying developed up to this time

Do teacher-made exercises (Postpone the use of a text at this stage.)

Solve pupil-made problems

Solve teacher-made problems centered around classroom activities

Do both seat practice and board practice

Check for correct work habits

HOW SOME TEACHERS DO IT

The answer came quickly, and Bob put the 12 pennies in one stack, counting as he did so.

"What can we do when we have 10 or more than 10 pennies?" asked Miss Briton. Again the answer came quickly. (Exchange 10 pennies for 1 dime.)

Susan exchanged the 10 pennies for a dime, which she stacked with the other 2 dimes. Miss Briton asked for a statement about the 12 pennies. Susan said, "Twelve pennies are 1 dime and 2 pennies." Miss Briton wrote the statement on the board. "Now let's see what we have here," said Miss Briton, and drew the children's attention to the coins again.

"Three dimes and 2 pennies are how many cents in all?" (The class automatically answered, "Thirty-two cents.")

"Now let's suppose we do not have any coins," she said as she put the coins in the cash box; "we just have the numbers that stand for the coins. Who would like to write the cost of the crepe paper on the board?" (Mary wrote 18c.) "Now, the cost of doilies?" (Tom wrote 14c.)

dimes	cents
1	8 ¢
1	4 ¢
3	2 ¢

"Now let's add to get the total." (Eight cents and 4c are 12c.)

"What did we do with the 12 pennies we had stacked?" (Exchanged them for a dime and 2c.)

"We're going to just *think* that now. Where does the 2c belong?" (Joe volunteered and wrote 2c)

"What did we do with the dime?" (Put it with the other 2 dimes.)

"Who can do that on the board?" (Patty volunteered and wrote 3.)

"Is that the same amount we got when we counted coins?" asked Miss Briton. All agreed that it was.

"Then we really don't have to carry a cash box around to add numbers like this, do we? All we need to do differently from what we've been doing is to remember to carry the dimes from the cents in the dimes' column. We call that 'carrying' in addition."

Just to show Miss Briton they could "carry" in their heads, the children thought out many more such money problems in the next few days, and it wasn't often that they had to resort to the cash box for help. "Carrying is easy," agreed most of the class.

Adding the Attendance

The attendance record was on the board, but Miss Briton had not yet totaled it. Instead she asked the 17 boys present to come to the front of the room and arrange themselves in groups of 10. She asked the boys'

Help pupils to add 2-place numbers (two addends, last sum 10 or more). Use such problems as the following:

Add the lunch money:

Boys	$.75
Girls	$.25

(See "The Sum Grows.")

Add the number of pages read in two reading books:

Streets and Roads 82 pages

Through the Seasons 69 pages

captain, Bob, to take charge. Then she asked Captain Carol to arrange the 14 girls present in groups of 10.

"We have only 1 group of 10 and 7 boys extra," reported Bob.

"And we have only 1 group of 10 and 4 girls extra," reported Carol.

Miss Briton asked the captains to line their tens up together. Then she looked at the extras. "How many children would we have if we put these 7 extra boys and 4 extra girls together?" she asked.

"Eleven," came Bob's quick response.

"Could we have another group of 10 children?" asked Miss Briton.

"Sure," said Bob, "and one extra. I'll be the extra."

Another group of 10 children was moved over with the first two groups. Then Miss Briton said, "Now let's count by tens to find the number of children all together." (Ten, 20, 30, and 1 are 31.)

"What are we going to do, Miss Briton?" asked Bob.

"You have already done it, Bob. You boys and girls have just acted out what has to go on in my head every time I add the attendance. I thought that if you children learned to add it, I would have one job less to do every morning. Now if you'd like to sit down, I'll show you what I mean."

Miss Briton wrote the problem on the board:

tens	ones	
1	7	boys
1	4	girls
3	1	children

"Today we are not adding money. We are adding children. We can't group children as dimes and cents, but we can group them as tens and ones as we just did." Then she proceeded exactly as she had done in presenting a problem that involved carrying money. (See "We Learn to Carry.")

"That's just like the carrying we've been doing in money problems," said Joseph.

"Not quite, Joseph," said Miss Briton. "Who would like to show Joseph one very important difference?"

Sharon explained to Joseph what Miss Briton had just pointed out to them. "We don't carry dimes in our head when we add children. We carry tens."

Then they spent some time in thinking of other things to add—such as books, pencils, seats, chairs, cray-

SUGGESTIVE ACTIVITIES

Teach pupils to add 2-place numbers to 1-place numbers, first sum more than 10 in each case.

18c	24 pencils
8c	9 pencils

Have children practice this type of addition in as many classroom situations as possible:

Finding total number of books of one kind

15 on 1 shelf
8 on another shelf

Finding total number of sheets of paper of two colors to determine the supply for art period

15 red
9 yellow

Use teacher-made exercises.

Help pupils to add 3-place numbers (2 addends, carrying from units only, last sum 9 or less, zeros). Use such problems as the following:

Find total number of miles traveled by Billy and his family in two days. (See "How Many Miles.")

Find the total cost of two new books for room library:

$1.48
1.25

Find total amount earned for the school by the last two school movies:

Our room
$1.05 Movie January 30
1.65 Movie January 25

Have children practice many exercises and problems of this type.

Continue to give problems of this type that require carrying from tens' place only (last sum 9 or less). (See "From Tens to Hundreds.")

235	250
493	265

HOW SOME TEACHERS DO IT

ons, and cookies that would involve carrying tens. On the following day everyone had a "carrying tens" problem for the class to solve.

The Sum Grows

Miss Briton's pupils know now that the quick way to do carrying problems is to carry the tens in their heads. Today, however, Miss Briton is having them add the lunch money, which will require another place in the sum. She takes them through each step carefully.

$.75	Five pennies and 5 pennies are 10 pen-
.25	nies.
$1.00	Ten pennies is 1 dime and 0 pennies.

What do you write in pennies' place?

What do you carry to the tens' column? (one dime.)

One dime and 7 dimes and 2 dimes are how many dimes?

What is 10 dimes? (One dollar and *no* dimes left over.)

What do you write in the dollar place to the *left* of the cents' place?

Miss Briton followed the same procedure in adding the number of pages read in the two reading books, using ones, tens, and hundreds rather than pennies, dimes, and dollars. (See "Adding the Attendance.")

Carrying to an Empty Space

The cash box was at hand again to help develop the concept of carrying to an empty space. There were 18c left in the Cookie Sale fund and 8c in the box in which the class kept unclaimed "lost" money. Miss Briton felt that the children had enough understanding of carrying to assure them against any difficulty with this new step. Nevertheless, she again went through the process with concrete materials:

dimes	*cents*	
1	8	Eighteen cents is 1 dime and 8
	8	pennies. We have another 8 pennies. Add the pennies first.
2	6	8 + 8 = 16.

Sixteen pennies are 1 dime and 6 pennies. Put the 6 pennies in the cents' place. Carry the dime to the dimes' place and add. Check with coins. Check by adding up.

tens	*ones*	
	9	We have 9 old pencils that are
2	4	still quite usable. We have 24 new pencils. Twenty-four pencils are 2 tens and 4 ones. Add 9 ones and 4 ones.

Thirteen pencils are 1 ten and 3 ones. Put the 3 ones in the ones' place. Add the 1 ten to the 2 tens in the

SUGGESTIVE ACTIVITIES

Have pupils practice many problems and examples. Include money problems. Use problems based on classroom situations and children's out-of-school experiences shared with the group.

Have children practice the changing of *from tens to hundreds* to *from cents to dollars* when money problems are to be solved.

Have children practice problems and exercises requiring carrying from both units' and tens' places.

HOW SOME TEACHERS DO IT

tens' place. (Check with pencils. Check by adding up.)

How Many Miles

Billy came back from a trip to his grandfather's with many interesting things to tell the children. He was especially proud of the long distance they had driven in two days in order that his father might get back to work on time. They had driven 326 miles the first day and 429 the second day.

Mrs Wells remarked that Billy's father must have a good car and suggested that the class find out just how many miles Billy's family had driven in two days. Billy went to the board, and the class and Mrs Wells helped him add.

326
429
———
755

Mrs. Wells called attention to 3-place numbers and had the children name the places and tell where they should begin to add. She went through the adding procedures:

Add the ones first. Think "6 and 9 are 15." Fifteen is one ten and 5 ones. Write the 5 in the ones' place and carry the 1 ten. Think "3 tens and 2 tens" (because we're carrying 1 ten) and write 5 tens in the tens' place. Think "3 hundreds and 4 hundreds" and write 7 in the hundreds' place. Check by adding up. Billy's family traveled 755 miles in two days.

New Books Cost Money

Finding the cost of two new books for the library presents no difficulty. The children understand that in adding money, they carry cents and dimes. Mrs. Wells watches for any tendency to confuse cents' and dimes' places with ones and tens.

In adding
$1.05
1.65
———

Mrs. Wells reminds the children that the zero can be counted as an empty space and suggests that they recall carrying to an empty space and think of the cents' and dimes' places as 5c and then go on adding the hundreds. 65c

From Tens to Hundreds

There are 150 seats on one side of the central aisle in the school auditorium and 165 seats on the other side. The 3A's were getting ready to present an assembly to several other rooms and to the 3A parents. To find out whether or not they would have enough seats all together, they had to add 150 and 165.

Mrs. Wells was aware that this problem involved carrying from the tens' place. She had planned it that way, but she was certain that the pupils had had sufficient background experience with place values to make this step easy. When they came to adding 5 + 6 in the tens' place, she led them to tell *her* what to do.

"Do you remember what we do with the ones when the sum is 10 or more?" she asked. (Think tens and ones. Put down the ones and carry the tens.)

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills in adding by endings and bridging tens as a preparation for adding columns of addends accurately and rapidly. Have pupils do the following:

Recall the adding by endings done in 3B (See "Adding by Endings.")

Practice naming the next decade

Practice adding by tens from a number in the first decade (or from numbers in the second or third decade and so on)

Practice adding by endings, working from basic facts

Practice adding by endings without relying on basic facts

Apply adding by endings and bridging tens to column addition

Practice with many exercises

"What do you suppose we do with tens when we have 10 or more of them?" (No immediate response.) "What is the place to the left of the tens' place called?" (Hundreds.) "Do we have a hundred or more in 11 tens?"

"Sure," answered Bennie. "Ten tens are 100; so we have 100 and 1 ten over."

"Then what do you suppose we can do?" asked Mrs. Wells.

Bennie knew. So did several others. Bennie took the chalk, saying as he wrote, "We put the 1 ten in the tens' place and carry the hundred to the hundreds' place."

$$\begin{array}{r} 150 \\ 165 \\ \hline 315 \text{ seats} \end{array}$$

From Ones to Tens to Hundreds

Learning to carry tens and hundreds in the same problem was merely a matter of going over again step by step in a number of situations the material already developed. "Carry tens from the ones' place" and "Carry hundreds from the tens' place" were familiar slogans in Mrs. Wells' room until the carrying process became almost automatic. Even then, frequent check-ups were planned to see whether the children had a thorough understanding of the reason for carrying in addition.

Bridging Tens

Mrs. Gooden thinks her 3A pupils are ready to use the process of bridging tens in addition; so she has made the following plan, which, she believes, will unfold the process clearly and concisely:

Review adding by endings within the same decade, sums 19 or less:

15	13	16	18	19
4	3	2	1	0

Show the meaning of the "next decade." Reproduce a "tens" chart such as was used at earlier levels. Explain that 1-9 is the first decade, 10-19 the second, 20-29 the third, and so on. Have children note that there are 10 decades in a hundred. Give a number

	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

SUGGESTIVE ACTIVITIES

Extend skills in adding by using known processes in new situations. Have pupils do the following:

Add 3-place numbers to 2- or 1-place numbers (carrying):

28	8
346	279

Add 3-place numbers (carrying to zeros, nines, empty spaces):

498	806	64
228	187	689

Add 1- and 2-place numbers (3 and 4 addends):

8	9	23
6	3	69
6	5	21
8	—	—

Practice with many problems and exercises.

Extend skill in adding by endings in preparation for carrying in multiplying by 2 and 3. Have children do the following exercises:

Add mentally.

10 + 1 =	12 + 2 =
12 + 1 =	15 + 2 =
14 + 1 =	18 + 2 =
16 + 1 =	21 + 2 =
18 + 1 =	24 + 2 =
15 + 1 =	27 + 2 =
21 + 1 =	
27 + 1 =	
24 + 1 =	

Respond orally:

2 x 5 + 1 =	3 x 4 + 2 =
2 x 6 + 1 =	3 x 5 + 2 =
2 x 7 + 1 =	3 x 6 + 2 =
2 x 8 + 1 =	3 x 7 + 2 =
2 x + 1 =	3 x 8 + 2 =
	3 x 9 + 2 =

Drill for automatic response. (See "Racing Circle.")

HOW SOME TEACHERS DO IT

and let them respond with the corresponding number in the "next decade." Have children add by tens, beginning with a number in a given decade, as follows: 3, 13, 23, 33, and so on; 4, 14, 24, 34, and so on.

Show the practical use of the basic facts in bridging tens:

8	18	28	3	13	23	4
2	2	2	7	7	7	6
—	—	—	—	—	—	—

14	24	5	15	25
6	6	5	5	5
—	—	—	—	—

Have children practice adding by ending without relying on the basic facts. Use written exercises like these:

16	17	18	12	19	29	25	18
5	3	4	8	2	3	6	9
—	—	—	—	—	—	—	—

17	22
6	9
—	—

Have children practice adding by endings mentally. Dictate problems:

Add 7 to 14, 16, 19, 23, 15, 9, 13, 12.
Add 8 to 18, 13, 15, 14, 12, 11, 16, 9.

Apply bridging the tens to column addition. (Problems from classroom experiences are desirable.)

8
9
5
—

First experiences: Add down; think, "8 and 9 are 17 and 5 are 22." Later experiences: Add down; think, without naming each addend, "17, 22."

Include in examples basic facts needing more practice:

6	6	6	6	6	7	6	6
8	8	8	8	8	8	8	8
—	8	9	3	6	6	9	2
	—	—	—	3	8	9	8
				—	—	—	—

Using What We Know

The 3A children agree with Miss Graves in thinking that there's no real advantage in knowing something unless it can be of some use in daily living.

The day that they had the lunch money all counted ($1.35) and then Joe came in late with his 15c, they had to recall several things in adding on the 15c. Fifteen cents had to be written *$.15* in adding $1.35 to it:

$ .15
1.35
—
$1.50

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

They had to remember to carry from ones' to tens' place and to recognize that the dollar is not increased, only the cents.

Carrying to 9 was necessary in adding the pounds of paper brought in by the two 3A rooms:

295
516

But Joe, who was adding the numbers, was not at all perturbed. Explaining his process, he said confidently, "I just thought '10 tens and 1 ten are 11 tens.' "

When a zero appeared in an addend, the children remembered that they could think of it as an empty space because its only value is a place holder. (See *Addition of Integers*, 2B, 2A.) Adding is easy if you use what you know.

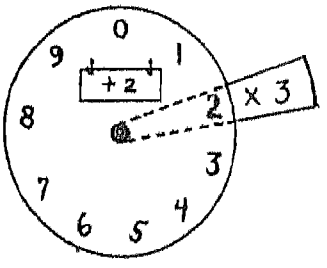
806
187

Racing Circle

Miss Graves had discovered that Racing Circle is one way to develop quick thinking and quick response. Before she goes far into the new process of multiplication, she arranges for the pupils to discover that they frequently need to multiply and add in the same problem:

97
x3
291

3 x 9 + 2 = 29



She wants them to discover that they can do such problems more quickly and easily if they know certain combinations so well that they aren't bothered when they encounter them. She uses the Racing Circle drill, which has proved very effective in increasing speed and accuracy. She makes sure that there are enough new racing circles to fit the current need.

Objective: To increase skills in using subtraction facts and processes already learned. To introduce borrowing.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Increase pupils' skills in using subtraction facts and processes already learned:

Have pupils subtract problems with 3-place minuends and 2- and 3-place subtrahends including zeros. Use problems arising from classroom experiences shared with the class.

Use the following subtraction terms frequently: ***minuend, subtrahend, remainder, difference, take away, from, minus, leaves.***

Have pupils check for accuracy

Watch Out for the Zero

Peter lives on an acreage. One morning he had something very exciting to tell the class. One hundred twenty-one baby chicks had been hatched at his house the day before. Peter and his father had taken 20 of them over to his grandmother's house.

"How many do you have left, Peter?" asked Miss Gaye, when Peter had finished.

Peter didn't know how many chicks he had left, but he knew he had to subtract to find out. He knew

SUGGESTIVE ACTIVITIES

Extend skills to borrowing in subtraction. Have pupils do the following:

Subtract examples which contain 2-place minuends and 2-place subtrahends, last remainder a zero. Have children work first with concrete materials, then with paper and pencil only.

Practice to know when to "break" a dime

(Must you "break" a dime if you have 2 dimes and have to pay 8c? If you have 1 dime and a nickel and have to pay 6c?)

Practice to know when to "break" a ten

(Must you "break" a ten if you have 2 stacks of 10 books each and 1 stack of 5 and you need 19?)

Think often of the things that can be done in borrowing in subtraction:

When there are not enough pennies in the minuend to subtract from, borrow a dime and change it to pennies.

When there are not enough ones in the minuend to subtract from, borrow a ten and break it into ones.

When we borrow a dime and change it to cents, we have *fewer* dimes in the remainder.

When we borrow a ten and change it to ones, we have *fewer* tens in the remainder.

Practice this phase of borrowing in many problems and examples, using many classroom and out-of-school experiences

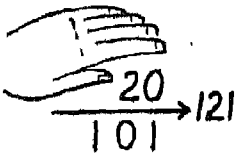
Do teacher-made exercises and tests

HOW SOME TEACHERS DO IT

that *121* was the minuend and that *20* was the subtrahend, and he knew how to write them:

$$\begin{array}{r} 121 \\ -\ 20 \\ \hline 101 \end{array}$$

Peter soon had the remainder. Miss Gaye had wondered when Peter began if the zero would bother him. But apparently he remembered that a zero is "only a place holder" and didn't change the 1 in the minuend at all. Then Peter checked his problem.



We Learn to Borrow

Miss Gaye had told the children to bring only 18c for milk on Monday because there were only 3 days of school this particular week. She had counted on a money situation that would promote her plan to introduce borrowing, and sure enough it happened just as she had anticipated.

"My mother didn't have 18c in change," said Susan. "She sent a quarter, and I can have the change myself. How much will I have left, Miss Gaye?"

Miss Gaye suggested that in the arithmetic period they would find out just how much Susan would have left. She recorded Susan's 25c on the board.

When arithmetic time came, she was ready with her old stand-by, the cash box. A discussion of Susan's problem pointed up these things: They would "break" (change) the quarter to take 18c out. Eighteen cents is 1 dime and 8c. Changing the quarter to 2 dimes and a nickel wouldn't help. Changing the quarter to 2 dimes and 5 pennies wouldn't help. One dime would have to be changed to pennies. One dime, 1 nickel, and 10 pennies was a good way in which to break the quarter for this situation.

Miss Gaye put a dime and 8 pennies in the milk money. She gave Susan the nickel and 2 pennies that were left. Susan announced that she had 7c left.

"Do you suppose that we could 'think' this quarter to dimes and cents and subtract as we do when we carry in addition?" asked Miss Gaye. "Let's try it."

It wasn't difficult with everyone helping. Bobby wrote the amount of Susan's money on the board. Mary wrote the amount to be taken out. Bill was selected to write the remainder as the class and Miss Gaye worked it out in this manner: "We cannot take 8c from 5c. We think: 'Change' a dime from the dimes' place to cents and *think* it to the cents' place. We can take 8c from 15c and have 7c left." (Bill records it in the remainder.)

dimes	cents
2	5 ¢
1	8 ¢

"There is 1 dime left in the minuend. We subtract the dime in the subtrahend and have no dimes left.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills in subtraction, using problems with 2-place minuends and 1-place subtrahends:

$$\begin{array}{r} 27 \\ -\ 6 \\ \hline \end{array}$$

Use classroom situations, such as finding daily attendance and out-of-school experiences shared with the class. Extend skills in subtraction, using problems with 3-place minuends and 3-place subtrahends and which require borrowing from one place (10's or 100's.)

$$\begin{array}{r} 342 \\ 145 \\ \hline \end{array} \qquad \begin{array}{r} 637 \\ 482 \\ \hline \end{array}$$

State often what to do when a ten has to be borrowed in a 3-place number: "Borrow the ten in the *same* way that we do in subtraction from a 2-place number."

Give children practice in changing a dollar to dimes in subtraction. Use many situations.

Give children practice in changing a hundred to tens in subtraction. Use many situations.

Extend skills in subtraction using problems with 3-place numbers which require borrowing in two places:

$$\begin{array}{r} 451 \\ 297 \\ \hline \end{array}$$

Utilize many classroom situations and out-of-school experiences shared with the group.

Use many teacher-made problems and examples.

Give practice in subtraction of problems with 2- and 3-place minuends and subtrahends and zero in the minuend:

$$\begin{array}{r} 70 \\ 28 \\ \hline \end{array} \qquad \begin{array}{r} 800 \\ 89 \\ \hline \end{array}$$

Bill does not need to record the zero. A zero is a place holder, and there is no reason to hold a place in this remainder."

"That's just 'carrying' backwards," said Joe.

"In subtraction we call the moving of dimes to the cents' place *borrowing*," said Miss Gaye. "*Carrying* in addition, *borrowing* in subtraction. Do you ever have to borrow something when you don't have enough?"

Much of the same procedure was used when 19 books were to be passed out from 2 stacks of 10 each and 1 stack of 5. Miss Gaye led the children to discover that they would have to break a 10 to get the 19. Then they worked it on the board:

tens	ones	
2	5	books
1	9	
		6 books left

Subtracting to Find Attendance

"Let's find our attendance by a different way this morning," suggested Miss Brooks. That alerted everyone. They liked "different" things. Miss Brooks went to the board and asked for the names of the absent children, row by row. She listed them: Ellen, Joan, Marvin, Joseph, Mary Ann. There were five. According to the membership on the masthead there should have been 32 children in the room. "Thirty-two children belong in our room. Five children stayed at home. What can we do to find how many children are left in the room today?" asked Miss Brooks. (Subtract.)

The children decided that 32 was the minuend. Alice wrote it on the board with the 5 beneath it:

$$\begin{array}{r} 32 \\ -\ 5 \\ \hline \end{array}$$

They proceeded to subtract as follows: "We cannot take 5 ones from 2 ones. We *can* borrow 1 ten and change it to ones for the ones' place. Now we have 12 ones minus 5 ones, which is 7 ones." (Alice wrote the 7.) "We have 2 tens now in the minuend. We have no tens in the subtrahend to subtract; so we still have 2 tens in the remainder."

Check

$$\begin{array}{r} 32 \\ -\ 5 \\ \hline 27 \end{array} = 32$$

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Utilize many classroom situations and out-of-school experiences shared with the group.

Use many pupil-made and teacher-made problems and exercises.

Changing Dollars to Dimes

The 3A's in Miss Stephen's room were proud of the $6 37 they had earned by collecting and selling paper in September. In January, however, their paper collection had brought them only $4.82.

"I wonder how much we dropped in our paper sale," queried Miss Stephen.

"Would you like to know just how much difference there is?"

This was a good problem to show the changing of a dollar to dimes in borrowing. The cents presented no difficulty. Two cents from 7 cents is 5 cents. Jack, who was recording, wrote it down. "Can we take 8 dimes from 3 dimes?" asked Miss Stephen. (No, agreed the class.) "What do we do when we have not enough pennies?" (Borrow a dime and change it.) "Then what can we do when we haven't enough dimes?" (Borrow a dollar and change it to dimes.) "How many dimes have we now?" (Thirteen dimes.) "Eight dimes from 13 dimes are how many dimes?" (Five.) (Jack recorded it.) "How many dollars have we left in the minuend?" (Five.) "Four dollars from 5 dollars leaves how many dollars?" (One.) (Jack recorded it and made the dollar sign.) They checked the work and concluded that their sales had dropped $1.55.

$6.37
4 82
——

Borrowing Twice

"I hope your 'thinkers' are really working well this morning," said Mrs Thomas, "because I have a big job for you to do." The children were used to Mrs. Thomas' talking about their "thinkers"; it was always a cue that something interesting would follow. So they listened for what was to come.

"I found out at the office this morning that there are 451 girls in our school and 297 boys. I've been wondering just how many more girls we have than boys."

"That's easy," said Joe. "We can subtract and find out." Mrs. Thomas didn't give a hint that this was a little harder to do than other problems they had done. Joe wrote the numbers on the board and the class began. They borrowed a ten and changed it to ones and then subtracted and had 4 for the remainder. They remembered that they now had only 4 tens left in the tens' place in the minuend. They recognized that they couldn't take 9 tens from 4 tens. Joe was temporarily puzzled. "We've already borrowed," he declared.

451
297
——
154

"Is there any reason why you can't borrow again if you need to?" asked Mrs. Thomas.

Then Joe caught the idea: Borrow a hundred (10 tens) from the 400 and subtract 9 from 14. "Now there are only 3 hundreds in the minuend. Two from 3 leaves 1. There are 154 more girls than boys in the school."

"Your 'thinkers' really surprised me," said Mrs. Thomas. "There were three changes you had to keep

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

in your head, and you did it very well." The rest of the arithmetic period was used for practicing other examples of this type offered by the children. Tim thought up a problem that required some real thinking:

900
239

661

Mrs. Thomas called their attention to the fact that they had no ones and no tens to start with, and so they couldn't borrow from the tens' place. What could they do? After some thinking through on this example they came up with this conclusion: Borrow a hundred, which is 10 tens; borrow a ten, which is 10 ones; 9 ones from 10 ones is 1; 3 tens from 9 tens is 6; 2 hundreds from 8 hundreds is 6.

Objective: To develop the concept of multiplication and skill in using the process

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

THIRD SIX WEEKS

Introduce the concept of multiplication through the common daily experiences of the children. Have them do the following:

Buy postage stamps

Buy school supplies

Requisition materials

Figure library fines

Shop for the Red Cross box

Count the days in two weeks (2 sevens)

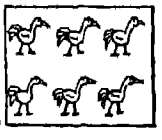
Count the children in two rows (2 sixes)

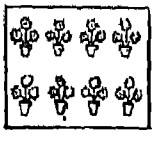
Recognize that multiplication by 2 means *twice as much*

Finding scores: 2 turns, 3 (4, 5, 6, 7, 8, 9) points for each turn

Use number pictures (2 threes, 2 fours, and so on)

Compare ways of finding totals





Counting 1, 2, 3, 4, 5, 6,

Adding 3 + 3 = 6

Multiplying 2 threes are 6
2 x 3 = 6

Practice the multiplication facts

Matching number pictures of facts and their reverses

Using flash cards (See *Addition of Integers*, 3B, 3A.)

By Twos

Many daily experiences of the 3A pupils came to the aid of Miss Burke when she was ready to introduce multiplication. There was the time Nancy brought 2 letters and 6c for Miss Burke to keep until school was out. The class checked Nancy's money. Was it enough to buy two 3c stamps? Yes, because 2 threes are 6. 2 x 3 = 6

Then there was the time Billy bought 2 small boxes of crayons, one for himself and one for his little sister. "We always have to get 2 of everything," said Billy. "My little sister wants just what I have."

"Then Mother has to give you twice as much money when you shop, doesn't she, Billy?" said Miss Burke. 1 x 2 = 2

On the morning that a library notice came saying Charles' library book was 2 days overdue, the class helped him figure his fine. Two days at 2c a day; 2 twos are 4. Charles owed 4c. 2 x 2 = 4.

For the 3A program 8 boys were doing a flag drill. Each boy needed 2 flags. How many had to be requisitioned from the costume department? What a fine opportunity to learn that 2 x 8 = 16.

Two pads of paper at 5c each for the Red Cross boxes made 2 x 5 easy to remember.

Billy's father was gone 2 whole weeks. How many days was he gone? 2 x 7 = 14. Two weeks is *twice* as long as one.

Number Pictures

Identifying and matching number facts by means of number pictures prepares the way for drilling on these facts when the time comes to do so. Miss Burke has a complete set for the facts of 2 and their reverses (2 fours, 4 twos, and so on). She uses them in varied exercises like the following:

SUGGESTIVE ACTIVITIES

Dramatizing, checking, and recording facts, such as $2 \times 3 = 6$

(Mary's mother has 3 children; John's mother has twice that many children. Mary's "mother" chooses her family. John's "mother" chooses her *family*.)

Have pupils do the following:

Recall that *all* signs and all answers have a name and learn the sign for multiplication

+ means add; — means subtract; x means multiply

Recall the terms used in addition and subtraction and learn those used in multiplication:

2 *addend*	4 *minuend*
+ 4 *addend*	— 2 *subtrahend*
6 *sum*	2 *remainder*

4 *multiplicand*
x 2 *multiplier*
8 *product*

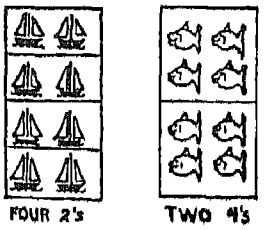
Apply the right names in multiplication

Discover that there are products they need to know:

0	1	2	3	4	5	6	7	8	9
x2	x2	x2	x2	x2	x2	x2	x2	x2	x2
—	—	—	—	—	—	—	—	—	—
2	2	2	2	2	2	2	2	2	
x3	x4	x5	x6	x7	x8	x9	x1	x0	
—	—	—	—	—	—	—	—	—	
0	1	2	3	4	5	6	7	8	9
x3	x3	x3	x3	x3	x3	x3	x3	x3	x3
—	—	—	—	—	—	—	—	—	—

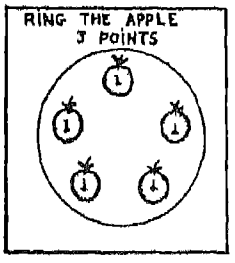
HOW SOME TEACHERS DO IT

1. Find the card that shows 2 fours (fives, sixes, and so on.)
2. Find the card that shows 2 fours and the one that shows 4 twos. Count the pictures on each card.



After the facts have been presented formally, Miss Burke uses the cards in drill. For example, she asks questions like this: "Who has the card that shows $2 \times 4 = 8$?"

Three Ways to Find a Score



In two turns at Ring the Apple, John scored and got 3 points each time. Miss Burke reminded the children that they could find John's score three ways: by counting tallies: *111 111* (but that was a first grade way); by adding: *3 + 3 = 6* (which they learned in second grade); by thinking *2 threes are 6* (which is a third grade way).

"This *third* grade way is called multiplying," she said. "We write it two ways: $3 \times 2 = 6$ or

3
x 2
—
6

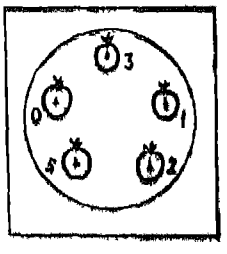
We read it, 'Three times two is six.'"

That wasn't hard to understand. Even when Martha scored 2 zeros it was easy to see that $0 \times 2 = 0$. She had 2 turns but still no score.

Adding or Multiplying

In a few days the turns at Ring the Apple were changed to 4 for each child, and 2 points were allowed for each apple. Ann made a perfect score. When she computed her score, she put down the numbers like this: *2 x 4 = 8*. Miss Burke felt that the time had come to show the children when it is practical to use multiplication; so again they considered the new way to get Ann's score: 4 twos, or $2 \times 4 = 8$.

Then Miss Burke changed the points of the game so that each apple had its own point value. Sue's scores on 4 chances were 2, 0, 1, 5. They found they had to go back to adding for the total score; they couldn't say 4 twos (or zeros, ones, fives) because there was only 1 of each number. They made a statement about it, which Miss Burke wrote on the board: When the numbers are the same, multiply; when the numbers are different, add.



SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils do the following:

Learn to multiply a 2-place number (last product 9 or less) in a meaningful situation:

Scoring a relay game

Figuring amount of ribbon needed for doll dress trimming (12 inches for 2 dolls each)

Checking by multiplying the second time

Learn to multiply a 2-place number (last product 10 or less) in a meaningful situation:

Figuring amount of milk money (2 children, 25c)

Using multiplication in classroom situations wherever two like numbers are involved

Practicing the multiplication facts of 2; using teacher-made exercises and pupil-made problems and exercises

Use similar procedures to develop the multiplication facts of 3.

Miss Burke now called their attention to Sue's and Ann's scores again:

"Sue's and Ann's total scores are the same," she said, "but they have different names. When Sue added she got the *sum* of 8. When Ann multiplied, she got '8,' too, but her answer is called a *product*."

The next day they had some more multiplication examples, and they wrote *product* by each answer.

Facts to Learn

The children in Miss Burke's room were led to see that multiplication facts could be as helpful in solving problems as the addition and subtraction facts. Drills and exercises were used to teach these facts and their reverses. (See *Addition of Integers*, 3B.)

Scoring a Relay Game

Both Tom and Bill had 14 children on their relay teams. The rule was that each player who finished within the time limit scored 2 points for his team.

Twelve players on Tom's team and 13 players on Bill's team finished. The children multiplied to get the score for Tom's team:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline \end{array}$$

Miss Burke reminded them to start with the ones as usual:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline 4 \end{array}$$

and then to multiply the tens by the same multiplier:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline 24 \end{array}$$

They multiplied in the same way to find the score for Bill's team:

$$\begin{array}{r} 13 \\ \times 2 \\ \hline 26 \end{array}$$

Just to be sure that the scores were right, they multiplied again and compared their products:

$$\begin{array}{rr} 12 & 13 \\ \times 2 & \times 2 \\ \hline 24 & 26 \end{array}$$

How Much Lunch Money?

Joe, Susan, and Mary brought 25c each for lunch today. Miss Burke suggested that now they didn't need to count coins any more or add They could multiply because all the numbers were the same. The children identified *25c* as the multiplicand and *3* as the multiplier. Miss Burke warned them that this problem had carrying in it, just like addition. They multiplied the ones first. Three fives are 15. They put down the 5 ones and remembered, or "carried," the 1 ten:

$$\begin{array}{r} 25c \\ 3 \\ \hline 5 \end{array}$$

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

They multiplied the tens next and added the 1 ten they had carried:

$$\begin{array}{r} 25 \\ \times\ 3 \\ \hline 75 \end{array}$$

They put the cent sign beside the answer because they were multiplying in cents:

$$\begin{array}{r} 25 \\ 3 \\ \hline 75\text{c} \end{array}$$

Miss Burke called their attention to the fact that in this problem they did *two* things: they multiplied to get the product and added when they carried to the tens' place

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Objective: To introduce the concept and process of division.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Help pupils to discover the relationship between multiplication and division by having them recall the multiplication facts.

Help children to discover the corresponding division facts:

2 x 2 = 4	4 ÷ 2 = 2
2 x 3 = 6	6 ÷ 2 = 3
2 x 4 = 8	8 ÷ 2 = 4
2 x 5 = 10	10 ÷ 2 = 5
2 x 6 = 12	12 ÷ 2 = 6
2 x 8 = 16	16 ÷ 2 = 8
2 x 9 = 18	18 ÷ 2 = 9

Help children to learn to write and to read divisions:

$2\overline{)10}$ There are 5 twos in 10. 10 ÷ 2 = 5.
10 is the dividend.
2 is the divisor.
5 is the quotient

$$\begin{array}{r} 5 \\ \text{divisor } 2\overline{)10} \end{array} \quad \begin{array}{l} \textit{quotient} \\ \textit{dividend} \end{array}$$

Learning About Division

One morning at arithmetic period, Miss Marvin asked four children to come to the front of the room. She looked at them for a moment and then remarked thoughtfully, "I need *twice* this many children."

"Will you please come over with the first four?" requested Miss Marvin of four more children. "Now, how many children have we?" she asked. The response was immediate. Miss Marvin showed that she was pleased. "You know your 'two times' facts well," she remarked as she wrote the multiplication fact on the board:

2 fours are 8 *2 x 4 = 8.*

"Now," she continued, "I'd like these eight children divided so that there will be an *equal* number standing at either side of the room. Who can do it for me?"

Susan did it very quickly. Then Miss Marvin asked Bennie to check Susan's work by counting the number in each group.

Bennie didn't really need to count them because he knew there were four; but he liked counting each group, and Miss Marvin wanted to be sure that everyone saw the 2 fours. She knew they would watch Bennie and check on him.

"Two fours are 8, and 8 divided by 2 is 4," said Miss Marvin. She went to the board and wrote these facts by the other facts:

2 x 4 = 8 8 ÷ 2 = 4

"What's that funny thing in the middle?" asked Joe.

"That's a new sign," answered Miss Marvin. "You remember that we divided the 8 children into 2 *equal* groups, that is, groups with the same number of children in each group. We found that there were two groups of

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

4 children. This sign ÷ means *divided by* and is read that way: 'eight *divided by* two equals four.'"

Miss Marvin used books to show that 2 × 3 = 6 and 6 ÷ 3 = 2. Then she put some corresponding multiplication and division facts on the board and suggested that the children think of some ways to show them. Pencils, erasers, chalk, crayons, and chairs were used in *combining equal* groups and *dividing* into equal groups. It became clear to most of them that the product of every multiplication fact could be divided.

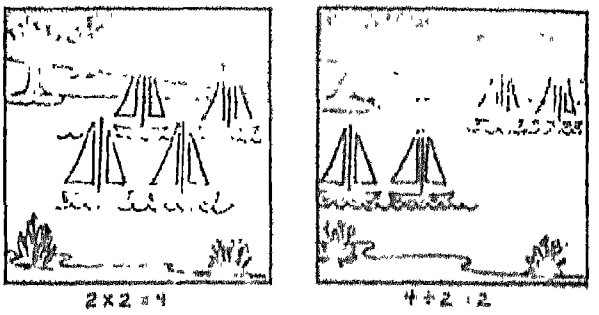
Develop a fact chart for division.

Use semiconcrete materials to demonstrate the relationship between multiplication and division.

Record the facts as they are developed.

Developing a Fact Chart for Division

"I have a puzzle for you today," said Miss Marvin as she hung a picture chart on the bulletin board beside a chart of facts used the day before.



"This is a picture puzzle of a multiplication fact and the division fact that corresponds to it. Who can discover which facts they are?"

After a brief scrutiny, the hands began to come up. Carol identified the fact on the chart and read it orally.

"May we make some picture puzzles?" asked Carol. Miss Marvin had counted on that reaction and had the materials all ready. She gave them ten minutes in which to make as many puzzles as possible. As the puzzles were shared and the facts guessed, Miss Marvin recorded them, writing each fact two ways:

Multiplication	*Division*
2 × 6 = 12	12 ÷ 2 = 6
Two 6's are 12	6
	2/12

She explained the third way of writing division, telling the children that it read: "There are three *threes* in nine."

Have pupils learn to check division by multiplication.

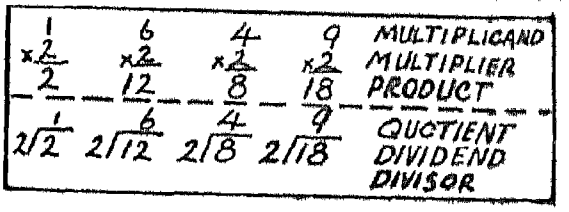
Help pupils to recognize the close relationship between multiplication and division facts.

In the "two times" facts and the "division by two" facts, the numbers are just the opposite because the process is the opposite.

Give drill on the division facts of 2. Use study cards, flash cards, games, and devices. (See *Addition of Integers*, 3B, 2A, 2B.)

Learning to Check Division

The next day Miss Marvin had a different chart for the arithmetic period. From it the children discovered



SUGGESTIVE ACTIVITIES

Help children to learn the process of long division by dividing 2-place numbers (including zero, first number divisible):

24	10	20
2/48	2/20	2/40
4	2	4
—	—	—
8	0	0
8	0	0
—	—	—

Use many teacher-made and pupil-made problems and exercises for practice in division. (Avoid using text at this stage. Have pupils label the quotient.)

Teach children to divide a 3-place number. Have them do the following:

Divide the number of squares of paper for an art activity

Divide 1-, 2-, and 3-place numbers with zeros, whenever a situation for division occurs (even division only):

$1.20 quotient	103
2/$2.40	2/206
2	2
—	—
4	0
4	0
—	—
0	6
0	6

Think through and say the five steps in every division problem:

1. Divide 2 into 428. There are 2 twos in 4.
2. Place the figure in the quotient. 2

   2/428
3. Multiply 4

   —
4. Subtract .....
5. Bring down 2

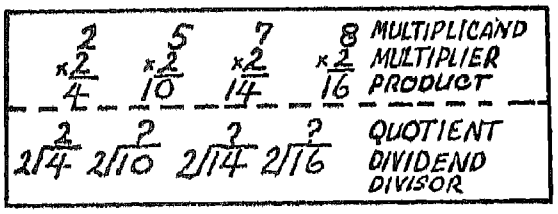
Repeat until each figure in the dividend has been brought down and used.

Use many teacher-made and pupil-made problems and exercises for practice in division. (Avoid using text at this stage.)

Continue to use such processes in developing division by 3.

HOW SOME TEACHERS DO IT

that the products became dividends, the multipliers divisors, and the multiplicands quotients. They saw, for example, that 2 x 2 = 4 and 4 ÷ 2 = 2. They also saw that by multiplying the quotient (2) by the divisor (2) they got the dividend (4), which showed that their answer to the division problem was correct. To make these facts more significant, Miss Marvin put up another chart that needed to be completed.



"I can do that," said Jimmy. "All you have to do is to copy the multiplicands and put them where the question marks are."

"Suppose I fold the chart so that the multiplicands don't show," said Miss Marvin.

"I can still do it because I could say, 'Two is 2 ones, 4 is 2 twos, 6 is 2 threes, and so on.'"

"That's just what I wanted you to do, Jimmy," laughed Miss Marvin. Then they discussed the chart and noticed that the multiplicands of the "two times" facts became the quotients in the corresponding division facts.

Dividing a Two-Place Number

The 3A's in Miss Marvin's room were planning to entertain the 2A's with a puppet show. There were 48 children to be seated in the audience. They decided to leave a center aisle and arrange an equal number of chairs on each side of the room. They knew that to find out how many chairs would be needed for each side, they should divide by 2. But they did not know the complete process of division, and Miss Marvin used this situation to demonstrate division of a 2-place number:

How many twos are there in 4? (Two.) We put the figure *2* in the quotient just above the 4 because the 4 is what we divided.

Now we multiply the quotient by the multiplier 2 x 2 = ? (Four). We put this 4 right under the 4 in the dividend. We subtract to find whether there is a remainder. There is no remainder to put down.

Now we need to divide the 8. We bring it down here because it is our next dividend.

How many twos in 8? (Four). We put the figure 4 in the quotient above the 8. We multiply it by the 2. (2 fours = 8). We put this 8 right under the 8 in the dividend. We subtract. There is no remainder to put down. All we have left to do is the checking.

Now we can be sure that we need 24 chairs on each side of the aisle.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Dividing a Three-Place Number

When the [illegible] May baskets, Miss Marvin [illegible] for them as a problem in division [illegible] that they would be working for two [illegible] on May baskets and that the 128 [illegible] all the paper they would have for the [illegible] suggested that they divide it into two equal parts so that there would be an equal amount for each period. They wrote their problem on the board: 128 [illegible] Then they put it down in long division form to solve. Since there was a new step in this problem, Miss Marvin explained the process step by step.

6

2/128 There are no [illegible] the 12 for the first dividend. There are [illegible] in 12. [illegible] that it [illegible]

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
	Four dimes divided by 2 are 2 dimes. Put the dimes in the dimes' place. Now go ahead as in other division problems.
$1.24 2 —— $2.48	Eight cents divided by 2 is 4 cents. Put the cents in the cents' place and finish the problem. Check it.
	Judy may spend $1.24 for each gift.

Objective: To extend the use of denominate numbers.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils do the following:

Practice making change from $1.00, using the counting method:

Amount spent 60c

Count change to 70c with a dime, to 75c with a nickel, and to $1.00 with a quarter, saying "60c, 70, 75, $1.00."

Amount spent 45c

Count change to 50c with a nickel and to $1.00 with a half dollar (or 2 quarters), saying "45c, 50c, $1.00."

Practice making change from amounts over $1.00—for example, $3.00:

Amount spent $2.45

Count change to 50c with a nickel and to $3.00 with a half dollar, saying $2.45, 2.50, and 50 is $3.00."

Continue to make change in many classroom situations (playing store, conducting a sale, or handling funds)

Recall the use in classroom situations of other measurements, such as inches, feet, years, minutes, hours, weeks, days, months, yards, pounds, ounces, dozens

Have pupils do the following:

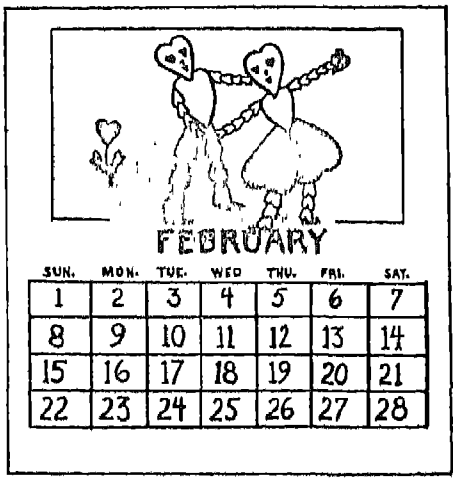
Discover that it is often convenient to abbreviate the measurements used

Use abbreviations for measurements in classroom experiences:

Labeling articles in classroom store: eggs, 60c doz.; butter, 80c lb.; ribbon, 25c yd.; tea, 4 oz., 35c; milk, 22c qt.; ice cream, 40c pt., $1.85 gal.

Abbreviations

Mrs. Swenson had just put an attractive new calendar on the bulletin board.



The children were admiring the calendar picture, which reminded them that Valentine's Day was not far away. One of the first things they did was to find when Valentine's Day would come and write it on the board.

They were used to writing the date the "short way" (Feb. 14) and the days the "short way" (Sun., Mon.). Sometimes the pupil whose turn it was to write the date on the board would ask, "Shall I write it the short way or the long way?"

Mrs. Swenson wanted the children to think about the new month She played a trick on them (they decided later). She wrote a little story on the board and slipped in some new short ways of writing words, which they had to figure out Here is the story:

The new mo. is February. The yr. is 1953.

Valentine's Day comes in the second wk. of the mo.

There are three full wks. in Feb.

The 1st day of February comes on Fri.

February is a winter mo.

SUGGESTIVE ACTIVITIES

Review concepts of measurement learned at earlier levels and extend skills in using them.

Have pupils use measurements in classroom situations whenever possible.

Drawing lines of various lengths as needed

Measuring bulletin boards, reading thermometer, and so on

Have pupils select correct measurement in Column B to complete each statement in Column A.

A	B
1. Butter is sold	a. By the dozen
2. Milk is sold	b. By the dozen or the bunch
3. Flowers are sold	c. By the quart or pint or gallon
4. Eggs are sold	d. By the pound
5. Ice cream is sold	
6. Shoes are sold	e. By the half-pint
7. Cream is sold	
8. Rolls are sold	f. By the pair

Have pupils classify the items below according to the way they are sold.

These things are usually sold by the

Dozen	Pound	Pair	Yard
gloves	potatoes	sugar	
candy	cheese	tea	
doughnuts	eggs	flour	
cookies	skates	galoshes	
coffee	stockings	ribbon	
blue jeans	mittens	dress material	
oranges	meat	prunes	
shoes	lemons	rope	

Have pupils arrange units of measure in the order of their size, from smallest to largest:

gallon, half-pint, pint, quart

foot, mile, yard, block, inch

minute, hour, half-hour, quarter-hour

nickel, dime, dollar, half-dollar, quarter, penny

half-pound, ounce, pound, quarter-pound, ton

week, day, year, month, season

0°, 72°, 85°, 50°, 20°

Use problems and exercises to give practice in measuring.

HOW YOUR TEACHER DO IT

They had fun figuring out all of Mrs. Swenson's short ways of writing words, and when they did find out what they meant, they would write them on the board. They learned that these shortened forms were called *abbreviations*.

month—mo.
year—yr.
week—wk.
weeks—wks.
first—1st

"You'll have to watch what I write," laughed Mrs. Swenson. "I know many abbreviations, and I like to use them; but I'll always help you if you can't figure out what I mean."

A Quiz Quickie

Miss Bartley's "Quiz Quickies" on measurements really put the 3A's on their mettle, because the score depends on the number they can get right in a given time. Her file of "Quiz Quickies" includes the following:

Directions: Write the answers on a separate sheet of paper.

A. (Two minutes to work)

Which is more—

1. an ounce or a pound?
2. a ton or a pound?
3. a yard or a foot?
4. a nickel or a dime?
5. two skates or a pair of skates?
6. a dozen eggs or 9 eggs?
7. a month or a season?
8. a block or a mile?

B. (Two minutes to work)

What are the abbreviations?

1. inch
2. foot
3. yard
4. pound
5. week
6. month
7. year
8. hour

C. (Five minutes to work)

Name two things that we buy . . .

1. by the pound
2. by the yard
3. by the quart
4. by the pair
5. singly
6. by the gallon
7. by the quarter-pound
8. by the half-pint

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Using the Text

Whenever the 3A's in Miss Bracken's room have occasion to use a measuring device, they follow it up with additional practice from the textbook. Today they used their rulers to measure paper for an art activity. Tomorrow they will use exercises from their texts to give them additional practice with the foot ruler.

Springtime brings out the marbles and jacks and finds most children needing a bag for one or the other. Making a paper bag gives further practice with measurement. Pictures and directions make the job easy to do. A tape measure may be substituted for a ruler if desired.

Broad jumping, kite flying, and gardening are a few of the outdoor activities that appeal to children in the spring and present a fine opportunity for using measurement.

Measuring and multiplying join forces in many activities; for instance, there is an excellent opportunity for pupils to use what they have learned about the yardstick and to practice the "3 times" facts.

Objective: To develop a concept of ½ and ⅓ as related to division.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills developed at earlier levels. Have pupils do the following:

Separate groups into halves, fourths, thirds

Use half measures in playing store

Use half-pounds and quarter-pounds in playing store

Measure an inch and a half-inch with the ruler

Read time by half-hour, quarter-hour, and three-quarter-hour

Recognize ½ and ⅓ in groups and pictures

Help children to discover the relationship between ½ and division by 2. Have them do the following:

Separate a group and record it three ways:

$10 \div 2 = 5 \quad 2\overline{)10}^{\,5}$

½ of 10 = 5

Write one half as *1/2*; read ½ as *one-half*

Use ½ in many situations

Work exercises designed to point up the relationship between ½ and division by 2:

$2\overline{)18}^{\,?} \quad 18 \div 2 = ?$

½ of 18 = ?

Finding One-Half Quickly

The 3A's in Miss Merritt's room know their "two times" facts and their "division by 2" facts. (See *Multiplication of Integers*, 3A and *Division of Integers*, 3A.) They almost know their "one-half" facts too, but they don't know that they do. Miss Merritt thinks that after today it will be easy for them to learn the one-half facts.

At arithmetic time Miss Merritt chooses three leaders: Mary, Joe, and Sue. Then she gives each leader a group of ten children and a folded paper, saying, "You are to arrange your group so that it makes a picture of the problem on your paper, but the problem is a secret until I ask you to tell it."

In a very short time the leaders announce that they are ready. Miss Merritt looks at each group and says "These pictures are all alike. Surely I didn't write the same thing on all the papers. Write your problems on the board, and we'll check them."

The leaders write their problems on the board:

Joe	*Mary*	*Sue*
$10 \div 2 = 5$	$2\overline{)10}^{\,5}$	Two halves of 10 are 5 each.

They check. All correct! Then Tom notices the twinkle in Miss Merritt's eyes and exclaims, "Oh Miss Merritt, you were trying to fool us!"

"Not exactly 'fool' you, Tom," replies Miss Merritt. "I just wanted you to see that sometimes one

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
Develop ⅓ in a similar manner. Use objects to demonstrate. $6 \div 3 = 2 \quad \begin{array}{r} 2 \\ 3\overline{)6} \end{array} \quad \frac{1}{3}$ of $6 = 2$	thing is written and said in several different ways. Now I'm going to show you a short way to write Sue's problem." She writes beneath Sue's problem: *1/2 of 10 = 5.* "Isn't that easier than writing so many words?" They all agree. They practice writing ½ of all the even numbers to 18: ½ of 2 = ?; ½ of 4 = ?; ½ of 6 = ?; ½ of 8 = ? "Tomorrow we will find the answers to all of these," says Miss Merritt. And they do. It is easy when they discover that all they need to do is think, "How many twos in . . . ?" They check each example by arranging objects, such as ½ of 8 erasers, or ½ of 12 books. Miss Merritt finds that the "concrete, abstract, concrete" routine is still the most effective in developing a new concept. When they are ready to do the "one-third" facts, Miss Merritt will no doubt have another little scheme planned so that the one-thirds will be just as easy as the one halfs.

Objective: To teach children to use the decimal correctly.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
(The use of decimal points to designate cents in writing money has been developed in the sections on addition, subtraction, multiplication, and division.)	

Objective: To help children recognize problems in activities and apply the right processes in solving them.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
ALL SEMESTER Teach children to solve problems by using new addition and subtraction facts and measurements. Have children do the following: Find a problem in a classroom activity and solve it by the right process Complete problems and solve them by the right process *Directions:* Ask a question to make a problem out of these situations. Solve each problem. 1. Bill earned 5c on Monday, 74c on Tuesday, and 8c on Wednesday. 2. Mary has 25c, and Sue has 18c. 3. Judy gave 18 of her 34 pennies to her sister. Do problems derived from out-of-school experiences shared with the class Do problems which contain unnecessary data (See *Addition of Integers,* and *Subtraction of Integers* for further examples of types of problems.)	**Everybody Helps** There is orderly activity in Miss Beech's room today. The children are paired in working teams and are measuring each other by using yardsticks. Bill found that Sue was 1 yardstick and 11 inches tall. He added 36 and 11 and found that Sue was 47 inches tall. Miss Beach's children like to make problems from situations that she gives them. Here are Jack's problem and Mabel's problem from the same situation: *Mary has 25c, and Sue has 18c.* *Jack*: How much more than Sue did Mary have? 25c − 18c = 7c difference *Mabel*: How much did both Mary and Sue have? 25c + 18c = 43c sum Joe told the class that his father had bought a filling station for $9,650 and had just been operating it two days. On the first day he sold 458 gallons of gas and

Help pupils to add 2-place numbers (two addends, last sum 10 or more). Use such problems as the following:

Add the lunch money:

Boys	$.75
Girls	$.25

(See "The Sum Grows.")

Add the number of pages read in two reading books:

Streets and Roads	82 pages
Through the Seasons	69 pages

captain, Bob, to take charge. Then she asked Captain Carol to arrange the 14 girls present in groups of 10.

"We have only 1 group of 10 and 7 boys extra," reported Bob.

"And we have only 1 group of 10 and 4 girls extra," reported Carol.

Miss Briton asked the captains to line their tens up together. Then she looked at the extras "How many children would we have if we put these 7 extra boys and 4 extra girls together?" she asked.

"Eleven," came Bob's quick response.

"Could we have another group of 10 children?" asked Miss Briton.

"Sure," said Bob, "and one extra. I'll be the extra."

Another group of 10 children was moved over with the first two groups. Then Miss Briton said, "Now let's count by tens to find the number of children all together." (Ten, 20, 30, and 1 are 31.)

"What are we going to do, Miss Briton?" asked Bob.

"You have already done it, Bob. You boys and girls have just acted out what has to go on in my head every time I add the attendance. I thought that if you children learned to add it, I would have one job less to do every morning. Now if you'd like to sit down, I'll show you what I mean."

Miss Briton wrote the problem on the board:

tens	ones	
1	7	boys
1	4	girls
3	1	children

"Today we are not adding money. We are adding children. We can't group children as dimes and cents, but we can group them as tens and ones as we just did." Then she proceeded exactly as she had done in presenting a problem that involved carrying money. (See "We Learn to Carry.")

"That's just like the carrying we've been doing in money problems," said Joseph.

"Not quite, Joseph," said Miss Briton. "Who would like to show Joseph one very important difference?"

Sharon explained to Joseph what Miss Briton had just pointed out to them. "We don't carry dimes in our head when we add children. We carry tens."

Then they spent some time in thinking of other things to add—such as books, pencils, seats, chairs, cray-

Teach pupils to add 2-place numbers to 1-place numbers, first sum more than 10 in each case.

18c	24 pencils
8c	9 pencils

Have children practice this type of addition in as many classroom situations as possible:

Finding total number of books of one kind

15 on 1 shelf
8 on another shelf

Finding total number of sheets of paper of two colors to determine the supply for art period

16 red
9 yellow

Use teacher-made exercises.

Help pupils to add 3-place numbers (2 addends, carrying from units only, last sum 9 or less, zeros). Use such problems as the following:

Find total number of miles traveled by Billy and his family in two days. (See "How Many Miles.")

Find the total cost of two new books for room library:

$1.48
1.25

Find total amount earned for the school by the last two school movies:

Our room
$1.05 Movie January 30
1.65 Movie January 25

Have children practice many exercises and problems of this type.

Continue to give problems of this type that require carrying from tens' place only (last sum 9 or less). (See "From Tens to Hundreds.")

235	250
493	265

ons, and cookies that would involve carrying tens. On the following day everyone had a "carrying tens" problem for the class to solve.

The Sum Grows

Miss Briton's pupils know now that the quick way to do carrying problems is to carry the tens in their heads. Today, however, Miss Briton is having them add the lunch money, which will require another place in the sum. She takes them through each step carefully.

$.75	Five pennies and 5 pennies are 10 pen-
.25	nies.
$1.00	Ten pennies is 1 dime and 0 pennies.

What do you write in pennies' place?

What do you carry to the tens' column? (one dime.)

One dime and 7 dimes and 2 dimes are how many dimes?

What is 10 dimes? (One dollar and *no* dimes left over.)

What do you write in the dollar place to the *left* of the cents' place?

Miss Briton followed the same procedure in adding the number of pages read in the two reading books, using ones, tens, and hundreds rather than pennies, dimes, and dollars. (See "Adding the Attendance.")

Carrying to an Empty Space

The cash box was at hand again to help develop the concept of carrying to an empty space. There were 18c left in the Cookie Sale fund and 8c in the box in which the class kept unclaimed "lost" money. Miss Briton felt that the children had enough understanding of carrying to assure them against any difficulty with this new step. Nevertheless, she again went through the process with concrete materials:

dimes	*cents*	
1	8	Eighteen cents is 1 dime and 8
	8	pennies. We have another 8
		pennies. Add the pennies first.
2	6	8 + 8 = 16.

Sixteen pennies are 1 dime and 6 pennies. Put the 6 pennies in the cents' place. Carry the dime to the dimes' place and add. Check with coins. Check by adding up.

tens	*ones*	
	9	We have 9 old pencils that are
		still quite usable. We have 24
2	4	new pencils. Twenty-four pen-
		cils are 2 tens and 4 ones. Add
		9 ones and 4 ones.

Thirteen pencils are 1 ten and 3 ones. Put the 3 ones in the ones' place. Add the 1 ten to the 2 tens in the

Have pupils practice many problems and examples. Include money problems. Use problems based on classroom situations and children's out-of-school experiences shared with the group.

Have children practice the changing of *from tens to hundreds* to *from cents to dollars* when money problems are to be solved.

Have children practice problems and exercises requiring carrying from both units' and tens' places.

tens' place. (Check with pencils Check by adding up.)

How Many Miles

Billy came back from a trip to his grandfather's with many interesting things to tell the children. He was especially proud of the long distance they had driven in two days in order that his father might get back to work on time. They had driven 326 miles the first day and 429 the second day.

Mrs. Wells remarked that Billy's father must have a good car and suggested that the class find out just how many miles Billy's family had driven in two days. Billy went to the board, and the class and Mrs. Wells helped him add.

326 Mrs. Wells called attention to 3-place numbers and had the children name the places and tell where they should begin to add. She went through the adding procedures:
429
—
755

Add the ones first. Think "6 and 9 are 15." Fifteen is one ten and 5 ones. Write the 5 in the ones' place and carry the 1 ten. Think "3 tens and 2 tens" (because we're carrying 1 ten) and write 5 tens in the tens' place. Think "3 hundreds and 4 hundreds" and write 7 in the hundreds' place. Check by adding up. Billy's family traveled 755 miles in two days.

New Books Cost Money

Finding the cost of two new books for the library presents no difficulty. The children understand that in adding money, they carry cents and dimes. Mrs. Wells watches for any tendency to confuse cents' and dimes' places with ones and tens.

In adding \$1.05 Mrs. Wells reminds the children
1.65 that the zero can be counted as an
—— empty space and suggests that
they recall carrying to an empty
space and think of the cents' and dimes' places as 5c
and then go on adding the hundreds. 65c
—

From Tens to Hundreds

There are 150 seats on one side of the central aisle in the school auditorium and 165 seats on the other side. The 3A's were getting ready to present an assembly to several other rooms and to the 3A parents. To find out whether or not they would have enough seats all together, they had to add 150 and 165.

Mrs. Wells was aware that this problem involved carrying from the tens' place. She had planned it that way, but she was certain that the pupils had had sufficient background experience with place values to make this step easy. When they came to adding 5 + 6 in the tens' place, she led them to tell *her* what to do.

"Do you remember what we do with the ones when the sum is 10 or more?" she asked. (Think tens and ones. Put down the ones and carry the tens.)

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills in adding by endings and bridging tens as a preparation for adding columns of addends accurately and rapidly. Have pupils do the following:

Recall the adding by endings done in 3B (See "Adding by Endings.")

Practice naming the next decade

Practice adding by tens from a number in the first decade (or from numbers in the second or third decade and so on)

Practice adding by endings, working from basic facts

Practice adding by endings without relying on basic facts

Apply adding by endings and bridging tens to column addition

Practice with many exercises

"What do you suppose we do with tens when we have 10 or more of them?" (No immediate response.) "What is the place to the left of the tens' place called?" (Hundreds.) "Do we have a hundred or more in 11 tens?"

"Sure," answered Bennie. "Ten tens are 100; so we have 100 and 1 ten over."

"Then what do you suppose we can do?" asked Mrs. Wells.

Bennie knew. So did several others. Bennie took the chalk, saying as he wrote, "We put the 1 ten in the tens' place and carry the hundred to the hundreds' place."

```
 150
 165
 ---
 315 seats
```

From Ones to Tens to Hundreds

Learning to carry tens and hundreds in the same problem was merely a matter of going over again step by step in a number of situations the material already developed. "Carry tens from the ones' place" and "Carry hundreds from the tens' place" were familiar slogans in Mrs. Wells' room until the carrying process became almost automatic. Even then, frequent check-ups were planned to see whether the children had a thorough understanding of the reason for carrying in addition.

Bridging Tens

Mrs. Gooden thinks her 3A pupils are ready to use the process of bridging tens in addition; so she has made the following plan, which, she believes, will unfold the process clearly and concisely:

Review adding by endings within the same decade, sums 19 or less:

15	13	16	18	19
4	3	2	1	0

Show the meaning of the "next decade." Reproduce a "tens" chart such as was used at earlier levels. Explain that 1-9 is the first decade, 10-19 the second, 20-29 the third, and so on. Have children note that there are 10 decades in a hundred. Give a number

	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

Extend skills in adding by using known processes in new situations. Have pupils do the following:

Add 3-place numbers to 2- or 1-place numbers (carrying):

28	8
346	279

Add 3-place numbers (carrying to zeros, nines, empty spaces):

498	806	64
228	187	689

Add 1- and 2-place numbers (3 and 4 addends):

8	9	23
6	3	69
6	5	21
8	—	—
—		

Practice with many problems and exercises.

Extend skill in adding by endings in preparation for carrying in multiplying by 2 and 3. Have children do the following exercises:

Add mentally:

10 + 1 =	12 + 2 =
12 + 1 =	15 + 2 =
14 + 1 =	18 + 2 =
16 + 1 =	21 + 2 =
18 + 1 =	24 + 2 =
15 + 1 =	27 + 2 =
21 + 1 =	
27 + 1 =	
24 + 1 =	

Respond orally:

2 x 5 + 1 =	3 x 4 + 2 =
2 x 6 + 1 =	3 x 5 + 2 =
2 x 7 + 1 =	3 x 6 + 2 =
2 x 8 + 1 =	3 x 7 + 2 =
2 x . + 1 =	3 x 8 + 2 =
	3 x 9 + 2 =

Drill for automatic response. (See "Racing Circle.")

and let them respond with the corresponding number in the "next decade." Have children add by tens, beginning with a number in a given decade, as follows: 3, 13, 23, 33, and so on; 4, 14, 24, 34, and so on.

Show the practical use of the basic facts in bridging tens:

8	18	28	3	13	23	4
2	2	2	7	7	7	6
—	—	—	—	—	—	—

14	24	5	15	25
6	6	5	5	5
—	—	—	—	—

Have children practice adding by ending without relying on the basic facts. Use written exercises like these:

16	17	18	12	19	29	25	18
5	3	4	8	2	3	6	9
—	—	—	—	—	—	—	—

17	22
6	9
—	—

Have children practice adding by endings mentally. Dictate problems:

Add 7 to 14, 16, 19, 23, 15, 9, 13, 12.
Add 8 to 18, 13, 15, 14, 12, 11, 16, 9.

Apply bridging the tens to column addition. (Problems from classroom experiences are desirable.)

8
9
5
—

First experiences: Add down; think, "8 and 9 are 17 and 5 are 22." Later experiences: Add down; think, without naming each addend, "17, 22."

Include in examples basic facts needing more practice:

6	6	6	6	6	7	0	6
8	8	8	8	8	8	8	8
—	8	9	3	6	6	9	2
	—	—	—	3	8	9	8
				—	—	—	—

Using What We Know

The 3A children agree with Miss Graves in thinking that there's no real advantage in knowing something unless it can be of some use in daily living.

The day that they had the lunch money all counted ($1.35) and then Joe came in late with his 15c, they had to recall several things in adding on the 15c. Fifteen cents had to be written *$.15* in adding $1.35 to it:

$ .15
1.35
—
$1.50

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

They had to remember to carry from ones' to tens' place and to recognize that the dollar is not increased, only the cents.

Carrying to 9 was necessary in adding the pounds of paper brought in by the two 3A rooms:

295
516

But Joe, who was adding the numbers, was not at all perturbed. Explaining his process, he said confidently, "I just thought '10 tens and 1 ten are 11 tens.' "

When a zero appeared in an addend, the children remembered that they could think of it as an empty space because its only value is a place holder. (See *Addition of Integers*, 2B, 2A.) Adding is easy if you use what you know.

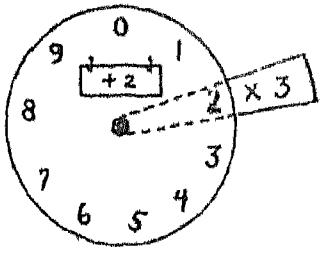
806
187

Racing Circle

Miss Graves had discovered that Racing Circle is one way to develop quick thinking and quick response. Before she goes far into the new process of multiplication, she arranges for the pupils to discover that they frequently need to multiply and add in the same problem:

97
x3
291

3 x 9 + 2 = 29



She wants them to discover that they can do such problems more quickly and easily if they know certain combinations so well that they aren't bothered when they encounter them. She uses the Racing Circle drill, which has proved very effective in increasing speed and accuracy. She makes sure that there are enough new racing circles to fit the current need.

Objective: To increase skills in using subtraction facts and processes already learned. To introduce borrowing.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Increase pupils' skills in using subtraction facts and processes already learned:

Have pupils subtract problems with 3-place minuends and 2- and 3-place subtrahends including zeros. Use problems arising from classroom experiences shared with the class.

Use the following subtraction terms frequently: *minuend, subtrahend, remainder, difference, take away, from, minus, leaves.*

Have pupils check for accuracy

Watch Out for the Zero

Peter lives on an acreage. One morning he had something very exciting to tell the class. One hundred twenty-one baby chicks had been hatched at his house the day before. Peter and his father had taken 20 of them over to his grandmother's house.

"How many do you have left, Peter?" asked Miss Gaye, when Peter had finished.

Peter didn't know how many chicks he had left, but he knew he had to subtract to find out. He knew

SUGGESTIVE ACTIVITIES

Extend skills to borrowing in subtraction. Have pupils do the following:

Subtract examples which contain 2-place minuends and 2-place subtrahends, last remainder a zero. Have children work first with concrete materials, then with paper and pencil only.

Practice to know when to "break" a dime

(Must you "break" a dime if you have 2 dimes and have to pay 8c? If you have 1 dime and a nickel and have to pay 6c?)

Practice to know when to "break" a ten

(Must you "break" a ten if you have 2 stacks of 10 books each and 1 stack of 5 and you need 19?)

Think often of the things that can be done in borrowing in subtraction:

When there are not enough pennies in the minuend to subtract from, borrow a dime and change it to pennies.

When there are not enough ones in the minuend to subtract from, borrow a ten and break it into ones.

When we borrow a dime and change it to cents, we have *fewer* dimes in the remainder.

When we borrow a ten and change it to ones, we have *fewer* tens in the remainder.

Practice this phase of borrowing in many problems and examples, using many classroom and out-of-school experiences

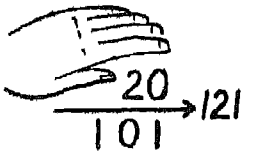
Do teacher-made exercises and tests

HOW SOME TEACHERS DO IT

that *121* was the minuend and that *20* was the subtrahend, and he know how to write them:

$$\begin{array}{r} 121 \\ -\ 20 \\ \hline 101 \end{array}$$

Peter soon had the remainder. Miss Gaye had wondered when Peter began if the zero would bother him But apparently he remembered that a zero is "only a place holder" and didn't change the 1 in the minuend at all. Then Peter checked his problem.



We Learn to Borrow

Miss Gaye had told the children to bring only 18c for milk on Monday because there were only 3 days of school this particular week. She had counted on a money situation that would promote her plan to introduce borrowing, and sure enough it happened just as she had anticipated.

"My mother didn't have 18c in change," said Susan. "She sent a quarter, and I can have the change myself. How much will I have left, Miss Gaye?"

Miss Gaye suggested that in the arithmetic period they would find out just how much Susan would have left. She recorded Susan's 25c on the board.

When arithmetic time came, she was ready with her old stand-by, the cash box. A discussion of Susan's problem pointed up these things: They would "break" (change) the quarter to take 18c out. Eighteen cents is 1 dime and 8c. Changing the quarter to 2 dimes and a nickel wouldn't help. Changing the quarter to 2 dimes and 5 pennies wouldn't help. One dime would have to be changed to pennies. One dime, 1 nickel, and 10 pennies was a good way in which to break the quarter for this situation.

Miss Gaye put a dime and 8 pennies in the milk money. She gave Susan the nickel and 2 pennies that were left. Susan announced that she had 7c left.

"Do you suppose that we could 'think' this quarter to dimes and cents and subtract as we do when we carry in addition?" asked Miss Gaye. "Let's try it."

It wasn't difficult with everyone helping. Bobby wrote the amount of Susan's money on the board, Mary wrote the amount to be taken out. Bill was selected to write the remainder as the class and Miss Gaye worked it out in this manner: "We cannot take 8c from 5c. We think: 'Change' a dime from the dimes' place to cents and *think* it to the cents' place. We can take 8c from 15c and have 7c left." (Bill records it in the remainder.)

dimes	cents
2	5¢
1	8¢

"There is 1 dime left in the minuend. We subtract the dime in the subtrahend and have no dimes left.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills in subtraction, using problems with 2-place minuends and 1-place subtrahends:

$$\begin{array}{r} 27 \\ -\ 6 \\ \hline \end{array}$$

Use classroom situations, such as finding daily attendance and out-of-school experiences shared with the class. Extend skills in subtraction, using problems with 3-place minuends and 3-place subtrahends and which require borrowing from one place (10's or 100's.)

$$\begin{array}{r} 342 \\ 145 \\ \hline \end{array} \qquad \begin{array}{r} 637 \\ 482 \\ \hline \end{array}$$

State often what to do when a ten has to be borrowed in a 3-place number: "Borrow the ten in the *same* way that we do in subtraction from a 2-place number."

Give children practice in changing a dollar to dimes in subtraction. Use many situations.

Give children practice in changing a hundred to tens in subtraction. Use many situations.

Extend skills in subtraction using problems with 3-place numbers which require borrowing in two places:

$$\begin{array}{r} 451 \\ 297 \\ \hline \end{array}$$

Utilize many classroom situations and out-of-school experiences shared with the group.

Use many teacher-made problems and examples.

Give practice in subtraction of problems with 2- and 3-place minuends and subtrahends and zero in the minuend:

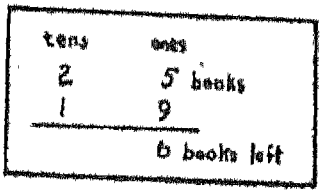
$$\begin{array}{r} 70 \\ 28 \\ \hline \end{array} \qquad \begin{array}{r} 800 \\ 89 \\ \hline \end{array}$$

Bill does not need to record the zero. A zero is a place holder, and there is no reason to hold a place in this remainder."

"That's just 'carrying' backwards," said Joe.

"In subtraction we call the moving of dimes to the cents' place *borrowing*," said Miss Gaye. "*Carrying* in addition, *borrowing* in subtraction. Do you ever have to borrow something when you don't have enough?"

Much of the same procedure was used when 19 books were to be passed out from 2 stacks of 10 each and 1 stack of 5. Miss Gaye led the children to discover that they would have to break a 10 to get the 19. Then they worked it on the board:



Subtracting to Find Attendance

"Let's find our attendance by a different way this morning," suggested Miss Brooks. That alerted everyone. They liked "different" things. Miss Brooks went to the board and asked for the names of the absent children, row by row. She listed them: Ellen, Joan, Marvin, Joseph, Mary Ann. There were five. According to the membership on the masthead there should have been 32 children in the room. "Thirty-two children belong in our room. Five children stayed at home. What can we do to find how many children are left in the room today?" asked Miss Brooks. (Subtract.)

The children decided that *32* was the minuend. Alice wrote it on the board with the *5* beneath it:

$$\begin{array}{r} 32 \\ -\ 5 \\ \hline \end{array}$$

They proceeded to subtract as follows: "We cannot take 5 ones from 2 ones. We *can* borrow 1 ten and change it to ones for the ones' place. Now we have 12 ones minus 5 ones, which is 7 ones." (Alice wrote the *7*.) "We have 2 tens now in the minuend. We have no tens in the subtrahend to subtract; so we still have 2 tens in the remainder."

Check

$$\begin{array}{r} 32 \\ -\ 5 \\ \hline 27 \end{array} = 32$$

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Utilize many classroom situations and out-of-school experiences shared with the group.

Use many pupil-made and teacher-made problems and exercises.

Changing Dollars to Dimes

The 3A's in Miss Stephen's room were proud of the $6.37 they had earned by collecting and selling paper in September. In January, however, their paper collection had brought them only $4.82.

"I wonder how much we dropped in our paper sale," queried Miss Stephen.

"Would you like to know just how much difference there is?"

This was a good problem to show the changing of a dollar to dimes in borrowing. The cents presented no difficulty. Two cents from 7 cents is 5 cents. Jack, who was recording, wrote it down. "Can we take 8 dimes from 3 dimes?" asked Miss Stephen. (No, agreed the class.) "What do we do when we have not enough pennies?" (Borrow a dime and change it.) "Then what can we do when we haven't enough dimes?" (Borrow a dollar and change it to dimes.) "How many dimes have we now?" (Thirteen dimes.) "Eight dimes from 13 dimes are how many dimes?" (Five.) (Jack recorded it.) "How many dollars have we left in the minuend?" (Five.) "Four dollars from 5 dollars leaves how many dollars?" (One.) (Jack recorded it and made the dollar sign.) They checked the work and concluded that their sales had dropped $1.55.

$$\begin{array}{r} \$6.37 \\ 4\ 82 \\ \hline \end{array}$$

Borrowing Twice

"I hope your 'thinkers' are really working well this morning," said Mrs. Thomas, "because I have a big job for you to do." The children were used to Mrs. Thomas' talking about their "thinkers"; it was always a cue that something interesting would follow. So they listened for what was to come.

"I found out at the office this morning that there are 451 girls in our school and 297 boys. I've been wondering just how many more girls we have than boys."

"That's easy," said Joe. "We can subtract and find out." Mrs. Thomas didn't give a hint that this was a little harder to do than other problems they had done. Joe wrote the numbers on the board and the class began. They borrowed a ten and changed it to ones and then subtracted and had 4 for the remainder. They remembered that they now had only 4 tens left in the tens' place in the minuend. They recognized that they couldn't take 9 tens from 4 tens. Joe was temporarily puzzled. "We've already borrowed," he declared.

$$\begin{array}{r} 451 \\ 297 \\ \hline 154 \end{array}$$

"Is there any reason why you can't borrow again if you need to?" asked Mrs. Thomas.

Then Joe caught the idea: Borrow a hundred (10 tens) from the 400 and subtract 9 from 14. "Now there are only 3 hundreds in the minuend. Two from 3 leaves 1. There are 154 more girls than boys in the school."

"Your 'thinkers' really surprised me," said Mrs. Thomas. "There were three changes you had to keep

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
	in your head, and you did it very well." The rest of the arithmetic period was used for practicing other examples of this type offered by the children. Tim thought up a problem that required some real thinking:

900
239

661

Mrs. Thomas called their attention to the fact that they had no ones and no tens to start with, and so they couldn't borrow from the tens' place. What could they do? After some thinking through on this example they came up with this conclusion: Borrow a hundred, which is 10 tens; borrow a ten, which is 10 ones; 9 ones from 10 ones is 1; 3 tens from 9 tens is 6; 2 hundreds from 8 hundreds is 6

Objective: To develop the concept of multiplication and skill in using the process

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

THIRD SIX WEEKS

Introduce the concept of multiplication through the common daily experiences of the children. Have them do the following:

Buy postage stamps

Buy school supplies

Requisition materials

Figure library fines

Shop for the Red Cross box

Count the days in two weeks (2 sevens)

Count the children in two rows (2 sixes)

Recognize that multiplication by 2 means *twice as much*

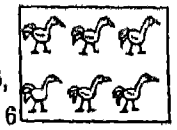
Finding scores: 2 turns, 3 (4, 5, 6, 7, 8, 9) points for each turn

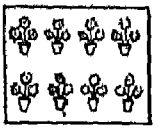
Use number pictures (2 threes, 2 fours, and so on)

Compare ways of finding totals

Counting 1, 2, 3, 4, 5, 6,

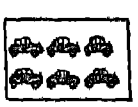
Adding 3 + 3 = 6





Multiplying 2 threes are 6
2 x 3 = 6

Practice the multiplication facts



Matching number pictures of facts and their reverses

Using flash cards (See *Addition of Integers*, 3B, 3A.)

By Twos

Many daily experiences of the 3A pupils came to the aid of Miss Burke when she was ready to introduce multiplication. There was the time Nancy brought 2 letters and 6c for Miss Burke to keep until school was out. The class checked Nancy's money. Was it enough to buy two 3c stamps? Yes, because 2 threes are 6. 2 x 3 = 6

Then there was the time Billy bought 2 small boxes of crayons, one for himself and one for his little sister. "We always have to get 2 of everything," said Billy. "My little sister wants just what I have."

"Then Mother has to give you twice as much money when you shop, doesn't she, Billy?" said Miss Burke. 1 x 2 = 2

On the morning that a library notice came saying Charles' library book was 2 days overdue, the class helped him figure his fine. Two days at 2c a day; 2 twos are 4. Charles owed 4c. 2 x 2 = 4.

For the 3A program 8 boys were doing a flag drill. Each boy needed 2 flags. How many had to be requisitioned from the costume department? What a fine opportunity to learn that 2 x 8 = 16.

Two pads of paper at 5c each for the Red Cross boxes made 2 x 5 easy to remember.

Billy's father was gone 2 whole weeks. How many days was he gone? 2 x 7 = 14. Two weeks is *twice* as long as one.

Number Pictures

Identifying and matching number facts by means of number pictures prepares the way for drilling on these facts when the time comes to do so. Miss Burke has a complete set for the facts of 2 and their reverses (2 fours, 4 twos, and so on). She uses them in varied exercises like the following:

SUGGESTIVE ACTIVITIES

Dramatizing, checking, and recording facts, such as 2 x 3 = 6

(Mary's mother has 3 children; John's mother has twice that many children. Mary's "mother" chooses her family. John's "mother" chooses her family.)

Have pupils do the following:

Recall that *all* signs and all answers have a name and learn the sign for multiplication

+ means add; — means subtract; x means multiply

Recall the terms used in addition and subtraction and learn those used in multiplication:

2 *addend*	4 *minuend*
+ 4 *addend*	— 2 *subtrahend*
6 *sum*	2 *remainder*

4 *multiplicand*
x 2 *multiplier*
8 *product*

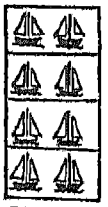
Apply the right names in multiplication

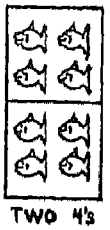
Discover that there are products they need to know:

0	1	2	3	4	5	6	7	8	9
x2	x2	x2	x2	x2	x2	x2	x2	x2	x2
—	—	—	—	—	—	—	—	—	—
2	2	2	2	2	2	2	2	2	
x3	x4	x5	x6	x7	x8	x9	x1	x0	
—	—	—	—	—	—	—	—	—	
0	1	2	3	4	5	6	7	8	9
x3	x3	x3	x3	x3	x3	x3	x3	x3	x3
—	—	—	—	—	—	—	—	—	—

HOW SOME TEACHERS DO IT

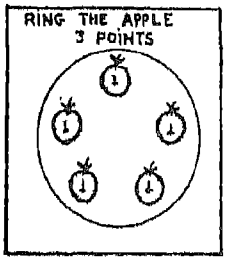
1. Find the card that shows 2 fours (fives, sixes, and so on.)
2. Find the card that shows 2 fours and the one that shows 4 twos. Count the pictures on each card.


FOUR 2's


TWO 4's

After the facts have been presented formally, Miss Burke uses the cards in drill. For example, she asks questions like this: "Who has the card that shows 2 x 4 = 8?"

Three Ways to Find a Score



In two turns at Ring the Apple, John scored and got 8 points each time. Miss Burke reminded the children that they could find John's score three ways: by counting tallies: *111 111* (but that was a first grade way); by adding: *3 + 3 = 6* (which they learned in second grade); by thinking *2 threes are 6* (which is a third grade way).

"This *third* grade way is called multiplying," she said. "We write it two ways: 3 x 2 = 6 or

3
x 2
—
6

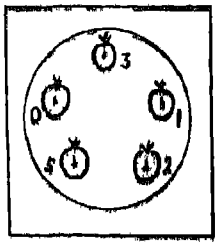
We read it, 'Three times two is six.' "

That wasn't hard to understand. Even when Martha scored 2 zeros it was easy to see that 0 x 2 = 0. She had 2 turns but still no score.

Adding or Multiplying

In a few days the turns at Ring the Apple were changed to 4 for each child, and 2 points were allowed for each apple. Ann made a perfect score. When she computed her score, she put down the numbers like this: *2 x 4 = 8.* Miss Burke felt that the time had come to show the children when it is practical to use multiplication; so again they considered the new way to get Ann's score: 4 twos, or 2 x 4 = 8.

Then Miss Burke changed the points of the game so that each apple had its own point value. Sue's scores on 4 chances were 2, 0, 1, 5. They found they had to go back to adding for the total score; they couldn't say 4 twos (or zeros, ones, fives) because there was only 1 of each number. They made a statement about it, which Miss Burke wrote on the board: When the numbers are the same, multiply; when the numbers are different, add.



SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils do the following:

Learn to multiply a 2-place number (last product 9 or less) in a meaningful situation:

Scoring a relay game

Figuring amount of ribbon needed for doll dress trimming (12 inches for 2 dolls each)

Checking by multiplying the second time

Learn to multiply a 2-place number (last product 10 or less) in a meaningful situation:

Figuring amount of milk money (2 children, 25c)

Using multiplication in classroom situations wherever two like numbers are involved

Practicing the multiplication facts of 2; using teacher-made exercises and pupil-made problems and exercises

Use similar procedures to develop the multiplication facts of 3.

Miss Burke now called their attention to Sue's and Ann's scores again.

"Sue's and Ann's total scores are the same," she said, "but they have different names. When Sue added she got the *sum* of 8. When Ann multiplied, she got '8,' too, but her answer is called a *product*."

The next day they had some more multiplication examples, and they wrote *product* by each answer.

Facts to Learn

The children in Miss Burke's room were led to see that [illegible] could be as helpful in solving prob[illegible] and subtraction facts. Drills and exercises were used to teach these facts and their reverses. (See *Addition of Integers*, 3B.)

Scoring a Relay Game

Both Tom and Bill had 14 children on their relay teams. The rule was that each player who finished within the time limit scored 2 points for his team.

Twelve players on Tom's team and 13 players on Bill's team finished. The children multiplied to get the score for Tom's team:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline \end{array}$$

Miss Burke reminded them to start with the ones as usual:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline 4 \end{array}$$

and then to multiply the tens by the same multiplier:

$$\begin{array}{r} 12 \\ \times 2 \\ \hline 24 \end{array}$$

They multiplied in the same way to find the score for Bill's team:

$$\begin{array}{r} 13 \\ \times 2 \\ \hline 26 \end{array}$$

Just to be sure that the scores were right, they multiplied again and compared their products:

$$\begin{array}{rr} 12 & 13 \\ \times 2 & \times 2 \\ \hline 24 & 26 \end{array}$$

How Much Lunch Money?

Joe, Susan, and Mary brought 25c each for lunch today. Miss Burke suggested that now they didn't need to count coins any more or add. They could multiply because all the numbers were the same. The children identified *25c* as the multiplicand and *3* as the multiplier. Miss Burke warned them that this problem had carrying in it, just like addition. They multiplied the ones first. Three fives are 15. They put down the 5 ones and remembered, or "carried," the 1 ten:

$$\begin{array}{r} 25c \\ 3 \\ \hline 5 \end{array}$$

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

They multiplied the tens next and added the 1 ten they had carried:

$$\begin{array}{r} 25 \\ \times\ 3 \\ \hline 75 \end{array}$$

They put the cent sign beside the answer because they were multiplying in cents:

$$\begin{array}{r} 25 \\ 3 \\ \hline 75c \end{array}$$

Miss Burke called their attention to the fact that in this problem they did *two* things: they multiplied to get the product and added when they carried to the tens' place.

Objective: To introduce the concept and process of division.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Help pupils to discover the relationship between multiplication and division by having them recall the multiplication facts.

Help children to discover the corresponding division facts:

2 x 2 = 4	4 ÷ 2 = 2
2 x 3 = 6	6 ÷ 2 = 3
2 x 4 = 8	8 ÷ 2 = 4
2 x 5 = 10	10 ÷ 2 = 5
2 x 6 = 12	12 ÷ 2 = 6
2 x 8 = 16	16 ÷ 2 = 8
2 x 9 = 18	18 ÷ 2 = 9

Help children to learn to write and to read divisions:

$2\overline{)10}$ There are 5 twos in 10. 10 ÷ 2 = 5.
10 is the dividend.
2 is the divisor.
5 is the quotient

5 *quotient*
divisor $2\overline{)10}$ *dividend*

Learning About Division

One morning at arithmetic period, Miss Marvin asked four children to come to the front of the room. She looked at them for a moment and then remarked thoughtfully, "I need *twice* this many children."

"Will you please come over with the first four?" requested Miss Marvin of four more children. "Now, how many children have we?" she asked. The response was immediate. Miss Marvin showed that she was pleased. "You know your 'two times' facts well," she remarked as she wrote the multiplication fact on the board:

2 fours are 8 *2 x 4 = 8.*

"Now," she continued, "I'd like these eight children divided so that there will be an *equal* number standing at either side of the room. Who can do it for me?"

Susan did it very quickly. Then Miss Marvin asked Bennie to check Susan's work by counting the number in each group.

Bennie didn't really need to count them because he knew there were four; but he liked counting each group, and Miss Marvin wanted to be sure that everyone saw the 2 fours. She knew they would watch Bennie and check on him.

"Two fours are 8, and 8 divided by 2 is 4," said Miss Marvin. She went to the board and wrote these facts by the other facts:

2 x 4 = 8 8 ÷ 2 = 4

"What's that funny thing in the middle?" asked Joe.

"That's a new sign," answered Miss Marvin. "You remember that we divided the 8 children into 2 *equal* groups, that is, groups with the same number of children in each group. We found that there were two groups of

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

4 children. This sign [illegible] means *divided by* and is read that way: "eight *divided by* two equals four."

Miss Marvin used books to show that 2 x 3 = 6 and 6 ÷ 3 = 2. Then she put some corresponding multiplication and division facts on the board and suggested that the children think of some ways to show them. Pencils, erasers, chalk, crayons, and chairs were used in *combining equal* groups and *dividing* into equal groups. *It became clear to most of them that the product of every* multiplication fact could be divided.

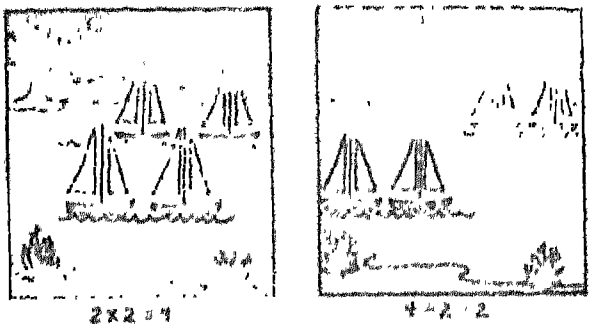
Develop a fact chart for division.

Use semiconcrete materials to demonstrate the relationship between multiplication and division

Record the facts as they are developed.

Developing a Fact Chart for Division

"I have a puzzle for you today," said Miss Marvin as she hung a picture chart on the bulletin board beside a chart of facts used the day before.



2 x 2 = 4   4 ÷ 2 = 2

"This is a picture puzzle of a multiplication fact and the division fact that corresponds to it. Who can discover which facts they are?"

After a brief scrutiny, the hands began to come up. Carol identified the fact on the chart and read it orally.

"May we make some picture puzzles?" asked Carol. Miss Marvin had counted on that reaction and had the materials all ready. She gave them ten minutes in which to make as many puzzles as possible. As the puzzles were shared and the facts guessed, Miss Marvin recorded them, writing each fact two ways:

Multiplication	*Division*
2 x 6 = 12	12 ÷ 2 = 6
Two 6's are 12	6
	2 12

She explained the third way of writing division, telling the children that it read: "There are three *threes* in nine."

Have pupils learn to check division by multiplication.

Help pupils to recognize the close relationship between multiplication and division facts.

In the "two times" facts and the "division by two" facts, the numbers are just the opposite because the process is the opposite.

Give drill on the division facts of 2. Use study cards, flash cards, games, and devices. (See *Addition of Integers*, 3B, 2A, 2B.)

Learning to Check Division

The next day Miss Marvin had a different chart for the arithmetic period. From it the children discovered

1	6	4	9	MULTIPLICAND
x2	x2	x2	x2	MULTIPLIER
2	12	8	18	PRODUCT
1	6	4	9	QUOTIENT
2/2	2/12	2/8	2/18	DIVIDEND
				DIVISOR

SUGGESTIVE ACTIVITIES

Help children to learn the process of long division by dividing 2-place numbers (including zero, first number divisible):

24	10	20
2/48	2/20	2/40
4	2	4
—	—	—
8	0	0
8	0	0
—	—	—

Use many teacher-made and pupil-made problems and exercises for practice in division. (Avoid using text at this stage. Have pupils label the quotient.)

Teach children to divide a 3-place number. Have them do the following:

Divide the number of squares of paper for an art activity

Divide 1-, 2-, and 3-place numbers with zeros, whenever a situation for division occurs (even division only):

$1.20 quotient	103
2/$2.45	2/206
2	2
—	—
4	0
4	0
—	—
0	6
0	6

Think through and say the five steps in every division problem:

1. Divide 2 into 428. There are 2 twos in 4.
2. Place the figure in the quotient. 2

2/428

3. Multiply 4
4. Subtract . . . . . —
5. Bring down 2

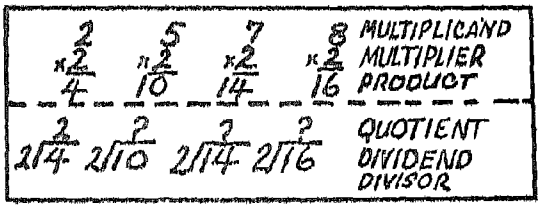
Repeat until each figure in the dividend has been brought down and used.

Use many teacher-made and pupil-made problems and exercises for practice in division. (Avoid using text at this stage.)

Continue to use such processes in developing division by 3.

HOW SOME TEACHERS DO IT

that the products became dividends, the multipliers divisors, and the multiplicands quotients. They saw, for example, that 2 x 2 = 4 and 4 ÷ 2 = 2. They also saw that by multiplying the quotient (2) by the divisor (2) they got the dividend (4), which showed that their answer to the division problem was correct. To make these facts more significant, Miss Marvin put up another chart that needed to be completed.



"I can do that," said Jimmy. "All you have to do is to copy the multiplicands and put them where the question marks are."

"Suppose I fold the chart so that the multiplicands don't show," said Miss Marvin.

"I can still do it because I could say, 'Two is 2 ones, 4 is 2 twos, 6 is 2 threes, and so on.'"

"That's just what I wanted you to do, Jimmy," laughed Miss Marvin. Then they discussed the chart and noticed that the multiplicands of the "two times" facts became the quotients in the corresponding division facts.

Dividing a Two-Place Number

The 3A's in Miss Marvin's room were planning to entertain the 2A's with a puppet show. There were 48 children to be seated in the audience. They decided to leave a center aisle and arrange an equal number of chairs on each side of the room. They knew that to find out how many chairs would be needed for each side, they should divide by 2. But they did not know the complete process of division, and Miss Marvin used this situation to demonstrate division of a 2-place number:

How many twos are there in 4? (Two.) We put the figure *2* in the quotient just above the 4 because the 4 is what we divided.

Now we multiply the quotient by the multiplier 2 x 2 = ? (Four). We put this 4 right under the 4 in the dividend. We subtract to find whether there is a remainder. There is no remainder to put down.

Now we need to divide the 8. We bring it down here because it is our next dividend.

How many twos in 8? (Four). We put the figure 4 in the quotient above the 8. We multiply it by the 2. (2 fours = 8). We put this 8 right under the 8 in the dividend. We subtract. There is no remainder to put down. All we have left to do is the checking.

Now we can be sure that we need 24 chairs on each side of the aisle.

Dividing a Three-Place Number

When the 3A's were getting ready to make May baskets, Miss Marvin used the paper she had cut for them as a problem in division. She told them that they would be working for two art periods on May baskets and that the 128 squares of paper was all the paper they would have for the two periods. She suggested that they divide it into two equal parts so that there would be an equal amount for each period. They wrote their problem on the board: 128 ÷ 2 = ? Then they put it down in long division form to solve. Since there was a new step in this problem, Miss Marvin explained the process step by step:

```
  6
2/128
  64
2/128
  12
  --
   8
   8
   -
```

There are no twos in 1; so we use the 12 for the first dividend. There are 6 twos in 12. We put the 6 right above the 2 to show that it was the 12, not the 1, that was divided. Now we go ahead as we do in other division problems. Now we check

```
 64
x 2
---
128
```

We will have 64 squares of paper for each art period.

Dividing Money

Judy had big news to share with her classmates. She had $2.48 that she had taken from her savings bank that morning. Miss Marvin was keeping it for her until school was out for the day. Then Judy was going shopping for a birthday gift for Daddy and a Mother's Day gift for Mother.

"I'll spend half for Daddy and half for Mother," she said. But she couldn't tell the pupils how much money that would be for each gift. The children discussed the problem briefly, and Jim volunteered a suggestion.

"There are two people to buy gifts for; so she'll have to divide her money by 2," he said. That's what they did.

Miss Marvin pointed up several things they needed to know in dividing money:

```
 $ .
2/$2.48
```

When money is divided, the quotient will be money, and the dollars, dimes, and cents must be in the right places.

```
 $1.24
2/$2.48
   2
   -
   4
   4
   -
   8
   8
   -
```

Two dollars divided by 2 is 1 dollar. Put the dollar in the dollars' place. Now go ahead as in other division problems.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Four dimes divided by 2 are 2 dimes. Put the dimes in the dimes' place. Now go ahead as in other division problems

$1.24 Eight cents divided by 2 is 4 cents. Put
2 the cents in the cents' place and finish the problem.
$2.48 Check it

Judy may spend $1.24 for each gift.

Objective: To extend the use of denominate numbers.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Have pupils do the following:

Practice making change from $1.00, using the counting method:

Amount spent 60c

Count change to 70c with a dime, to 75c with a nickel, and to $1.00 with a quarter, saying "60c, 70, 75, $1.00."

Amount spent 45c

Count change to 50c with a nickel and to $1.00 with a half dollar (or 2 quarters), saying "45c, 50c, $1.00."

Practice making change from amounts over $1.00—for example, $3.00:

Amount spent $2.45

Count change to 50c with a nickel and to $3.00 with a half dollar, saying $2.45, 2.50, and 50 is $3.00."

Continue to make change in many classroom situations (playing store, conducting a sale, or handling funds)

Recall the use in classroom situations of other measurements, such as inches, feet, years, minutes, hours, weeks, days months, yards, pounds, ounces, dozens

Have pupils do the following:

Discover that it is often convenient to abbreviate the measurements used

Use abbreviations for measurements in classroom experiences:

Labeling articles in classroom store: eggs, 60c doz.; butter, 80c lb.; ribbon, 25c yd.; tea, 4 oz., 35c; milk, 22c qt.; ice cream, 40c pt., $1.85 gal.

Abbreviations

Mrs. Swenson had just put an attractive new calendar on the bulletin board.

SUN.	MON	TUE.	WED	THU.	FRI.	SAT.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

The children were admiring the calendar picture, which reminded them that Valentine's Day was not far away. One of the first things they did was to find when Valentine's Day would come and write it on the board.

They were used to writing the date the "short way" (Feb. 14) and the days the "short way" (Sun., Mon.). Sometimes the pupil whose turn it was to write the date on the board would ask, "Shall I write it the short way or the long way?"

Mrs. Swenson wanted the children to think about the new month. She played a trick on them (they decided later). She wrote a little story on the board and slipped in some new short ways of writing words, which they had to figure out. Here is the story:

The new mo. is February. The yr. is 1953.

Valentine's Day comes in the second wk. of the mo.

There are three full wks. in Feb.

The 1st day of February comes on Fri.

February is a winter mo.

SUGGESTIVE ACTIVITIES

Review concepts of measurement learned at earlier levels and extend skills in using them.

Have pupils use measurements in classroom situations whenever possible.

Drawing lines of various lengths as needed

Measuring bulletin boards, reading thermometer, and so on

Have pupils select correct measurement in Column B to complete each statement in Column A.

A	B
1. Butter is sold	a. By the dozen
2. Milk is sold	b. By the dozen or the bunch
3. Flowers are sold	c. By the quart or pint or gallon
4. Eggs are sold	d. By the pound
5. Ice cream is sold	
6. Shoes are sold	e. By the half-pint
7. Cream is sold	
8. Rolls are sold	f. By the pair

Have pupils classify the items below according to the way they are sold.

These things are usually sold by the

Dozen	Pound	Pair	Yard
gloves	potatoes	sugar	
candy	cheese	tea	
doughnuts	eggs	flour	
cookies	skates	galoshes	
coffee	stockings	ribbon	
blue jeans	mittens	dress material	
oranges	meat	prunes	
shoes	lemons	rope	

Have pupils arrange units of measure in the order of their size, from smallest to largest:

gallon, half-pint, pint, quart

foot, mile, yard, block, inch

minute, hour, half-hour, quarter-hour

nickel, dime, dollar, half-dollar, quarter, penny

half-pound, ounce, pound, quarter-pound, ton

week, day, year, month, season

0°, 72°, 35°, 50°, 20°

Use problems and exercises to give practice in measuring.

HOW SOME TEACHERS DO IT

They had fun figuring out all of Mrs. Swenson's short ways of writing words, and when they did find out what they meant, they would write them on the board. They learned that these shortened forms were called *abbreviations*.

month—mo.	week—wk.
year—yr.	weeks—wks.
	first—1st

"You'll have to watch what I write," laughed Mrs. Swenson. "I know many abbreviations, and I like to use them; but I'll always help you if you can't figure out what I mean."

A Quiz Quickie

Miss Bartley's "Quiz Quickies" on measurements really put the 8A's on their mettle, because the score depends on the number they can get right in a given time. Her file of "Quiz Quickies" includes the following:

Directions: Write the answers on a separate sheet of paper.

A. (Two minutes to work)

Which is more—

1. an ounce or a pound?
2. a ton or a pound?
3. a yard or a foot?
4. a nickel or a dime?
5. two skates or a pair of skates?
6. a dozen eggs or 9 eggs?
7. a month or a season?
8. a block or a mile?

B. (Two minutes to work)

What are the abbreviations?

1. inch	5. week
2. foot	6. month
3. yard	7. year
4. pound	8. hour

C. (Five minutes to work)

Name two things that we buy . . .

1. by the pound	5. singly
2. by the yard	6. by the gallon
3. by the quart	7. by the quarter-pound
4. by the pair	8. by the half-pint

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Using the Text

Whenever the 3A's in Miss Bracken's room have occasion to use a measuring device, they follow it up with additional practice from the textbook. Today they used their rulers to measure paper for an art activity. Tomorrow they will use exercises from their texts to give them additional practice with the foot ruler.

Springtime brings out the marbles and jacks and finds most children needing a bag for one or the other. Making a paper bag gives further practice with measurement. Pictures and directions make the job easy to do. A tape measure may be substituted for a ruler if desired

Broad jumping, kite flying, and gardening are a few of the outdoor activities that appeal to children in the spring and present a fine opportunity for using measurement.

Measuring and multiplying join forces in many activities; for instance, there is an excellent opportunity for pupils to use what they have learned about the yardstick and to practice the "3 times" facts

---

Objective: To develop a concept of ½ and ⅓ as related to division.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Extend skills developed at earlier levels. Have pupils do the following:

Separate groups into halves, fourths, thirds

Use half measures in playing store

Use half-pounds and quarter-pounds in playing store

Measure an inch and a half-inch with the ruler

Read time by half hour, quarter-hour, and three-quarter-hour

Recognize ½ and ⅓ in groups and pictures

Help children to discover the relationship between ½ and division by 2. Have them do the following:

Separate a group and record it three ways:

$10 \div 2 = 5$ $\quad 2\overline{)10}^{\,5}$

½ of 10 = 5

Write one half as *1/2*; read ½ as *one-half*

Use ½ in many situations

Work exercises designed to point up the relationship between ½ and division by 2:

$2\overline{)18}^{\,9}$ $\quad 18 \div 2 = 9$

½ of 18 = 9

Finding One-Half Quickly

The 3A's in Miss Merritt's room know their "two times" facts and their "division by 2" facts. (See *Multiplication of Integers*, 3A and *Division of Integers*, 3A.) They almost know their "one-half" facts too, but they don't know that they do. Miss Merritt thinks that after today it will be easy for them to learn the one-half facts.

At arithmetic time Miss Merritt chooses three leaders: Mary, Joe, and Sue. Then she gives each leader a group of ten children and a folded paper, saying, "You are to arrange your group so that it makes a picture of the problem on your paper, but the problem is a secret until I ask you to tell it."

In a very short time the leaders announce that they are ready. Miss Merritt looks at each group and says "These pictures are all alike. Surely I didn't write the same thing on all the papers. Write your problems on the board, and we'll check them."

The leaders write their problems on the board:

Joe	*Mary*	*Sue*
$10 \div 2 = 5$	$2\overline{)10}^{\,5}$	Two halves of 10 are 5 each.

They check. All correct! Then Tom notices the twinkle in Miss Merritt's eyes and exclaims, "Oh Miss Merritt, you were trying to fool us!"

"Not exactly 'fool' you, Tom," replies Miss Merritt. "I just wanted you to see that sometimes one

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

Develop ⅓ in a similar manner. Use objects to demonstrate.

$6 \div 3 = 2 \quad \frac{2}{3\overline{)6}} \quad \frac{1}{3}$ of $6 = 2$

thing is written and said in several different ways. Now I'm going to show you a short way to write Sue's problem." She writes beneath Sue's problem *½ of 10 = 5*. "Isn't that easier than writing so many words?" They all agree.

They practice writing ½ of all the even numbers to 18: ½ of 2 = ?; ½ of 4 = ?, ½ of 6 = ?; ½ of 8 = ?

"Tomorrow we will find the answers to all of these," says Miss Merritt. And they do. It is easy when they discover that all they need to do is think, "How many twos in . . . ?" They check each example by arranging objects, such as ½ of 6 erasers, or ½ of 12 books.

Miss Merritt finds that the "concrete, abstract, concrete" routine is still the most effective in developing a new concept. When they are ready to do the "one-third" facts, Miss Merritt will no doubt have another little scheme planned so that the one-thirds will be just as easy as the one-halfs.

Objective: To teach children to use the decimal correctly.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

(The use of decimal points to designate cents in writing money has been developed in the sections on addition, subtraction, multiplication, and division.)

Objective: To help children recognize problems in activities and apply the right processes in solving them.

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

ALL SEMESTER

Teach children to solve problems by using new addition and subtraction facts and measurements.

Have children do the following:

Find a problem in a classroom activity and solve it by the right process.

Complete problems and solve them by the right process.

Directions:

Ask a question to make a problem out of these situations. Solve each problem.

1. Bill earned 5c on Monday, 74c on Tuesday, and 8c on Wednesday.
2. Mary has 25c, and Sue has 18c.
3. Judy gave 18 of her 34 pennies to her sister.

Do problems derived from out-of-school experiences shared with the class.

Do problems which contain unnecessary data. (See *Addition of Integers*, and *Subtraction of Integers* for further examples of types of problems.)

Everybody Helps

There is orderly activity in Miss Beech's room today. The children are paired in working teams and are measuring each other by using yardsticks. Bill found that Sue was 1 yardstick and 11 inches tall. He added 36 and 11 and found that Sue was 47 inches tall.

Miss Beach's children like to make problems from situations that she gives them. Here are Jack's problem and Mabel's problem from the same situation: *Mary has 25c, and Sue has 18c.*

Jack	*Mabel*
How much more than Sue did Mary have?	How much did both Mary and Sue have?
25c	25c
18c	18c
7c difference	43c sum

Joe told the class that his father had bought a filling station for $9,650 and had just been operating it two days. On the first day he sold 458 gallons of gas and

SUGGESTIVE ACTIVITIES

Have pupils solve problems, using the multiplication and division facts. Have them do the following:

Solve problems based on classroom situations and activities

Complete unfinished problems:

Directions: Ask a question to make problems out of these situations. Solve them.

1. Jane bought 2 pencils. They cost 5c each.
2. Ann has 2 dolls. Susan has twice that many.
3. Jim divided 8 cookies equally between Tom and himself.
4. Helen bought 2 candy bars. The clerk said, "That will be 12c."
5. Sue Ann had 15c to divide equally among three girls.

Do problems derived from out-of-school experiences shared with the class.

HOW SOME TEACHERS DO IT

on the second day 508 gallons. How many gallons of gas did he sell both days?

508
458
---
966 sum

How much more did he sell the second day than the first?

508
458
---
50 gallons more

An Inventory Test

(To be put in any form desired.)

1. What number has 2 thousands, 8 hundreds, 6 tens, and 4 ones?
2. Write two dollars and sixty-five cents in numbers.
3. What time is it when the minute hand points to 6 and the hour hand is in between 8 and 9?
4. Look at the calendar. On what dates do Mondays come this month?
5. Arrange these in the order of their size: foot, mile, inch, and yard.
6. Write the correct name by each of these answers:

14	428	15	24
+26	−226	x 3	2/48
---	---	---	4
40	202	45	---
			8
			8
			---

7. How many are ½ of 18 children? One-third of 24 pencils?
8. Name something that is sold by the pound; the gallon; 10 pounds.
9. Do these problems:

97	200	3/990	438	287
x 2	x 3		−269	−253
---	---		---	---

10. Which of these signs means to multiply: +, x, −, ÷ ?
11. Which of these signs means to divide: x, +, ÷, − ?
12. Make a picture to illustrate each of these things: one foot; height; date; a.m.; pair; herd.
13. Match:

A.	
(1) 5 + 5	(a) 2 x 3
(2) 3 + 3	(b) 2/12
(3) 12 ÷ 2	(c) 6 x 2
(4) 2 x 6	(d) 3 x 3
(5) 3 + 3 + 3	(e) 2 x 5

SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT

B.

(1) subtract	(a) x
(2) multiply	(b) —
(3) divide	(c) +
(4) add	(d) ÷

C.

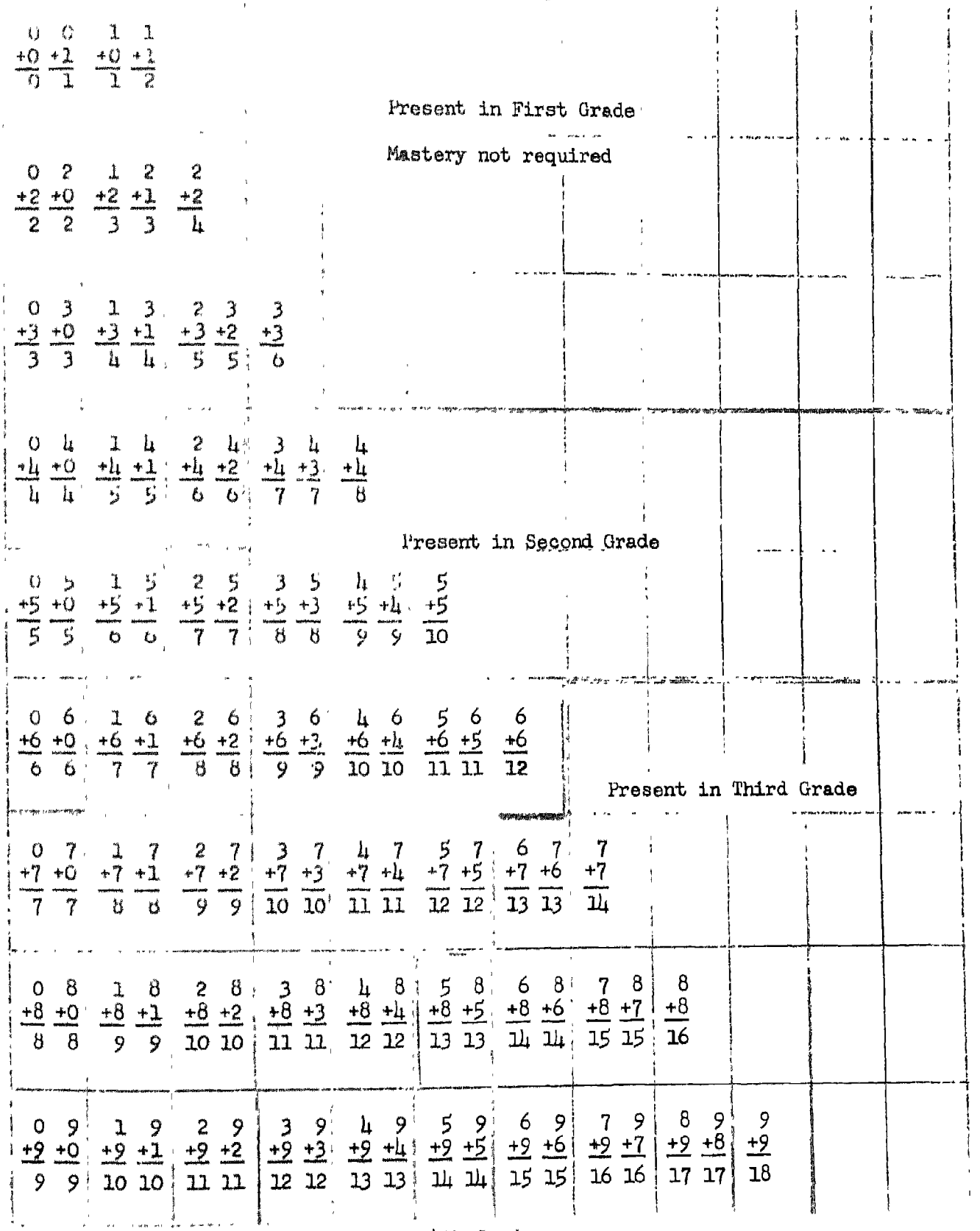
(1) ton	(a) time
(2) p.m.	(b) weight
(3) gallon	(c) length
(4) yard	(d) capacity

Objective: To teach children to use arithmetical terms in a meaningful way.

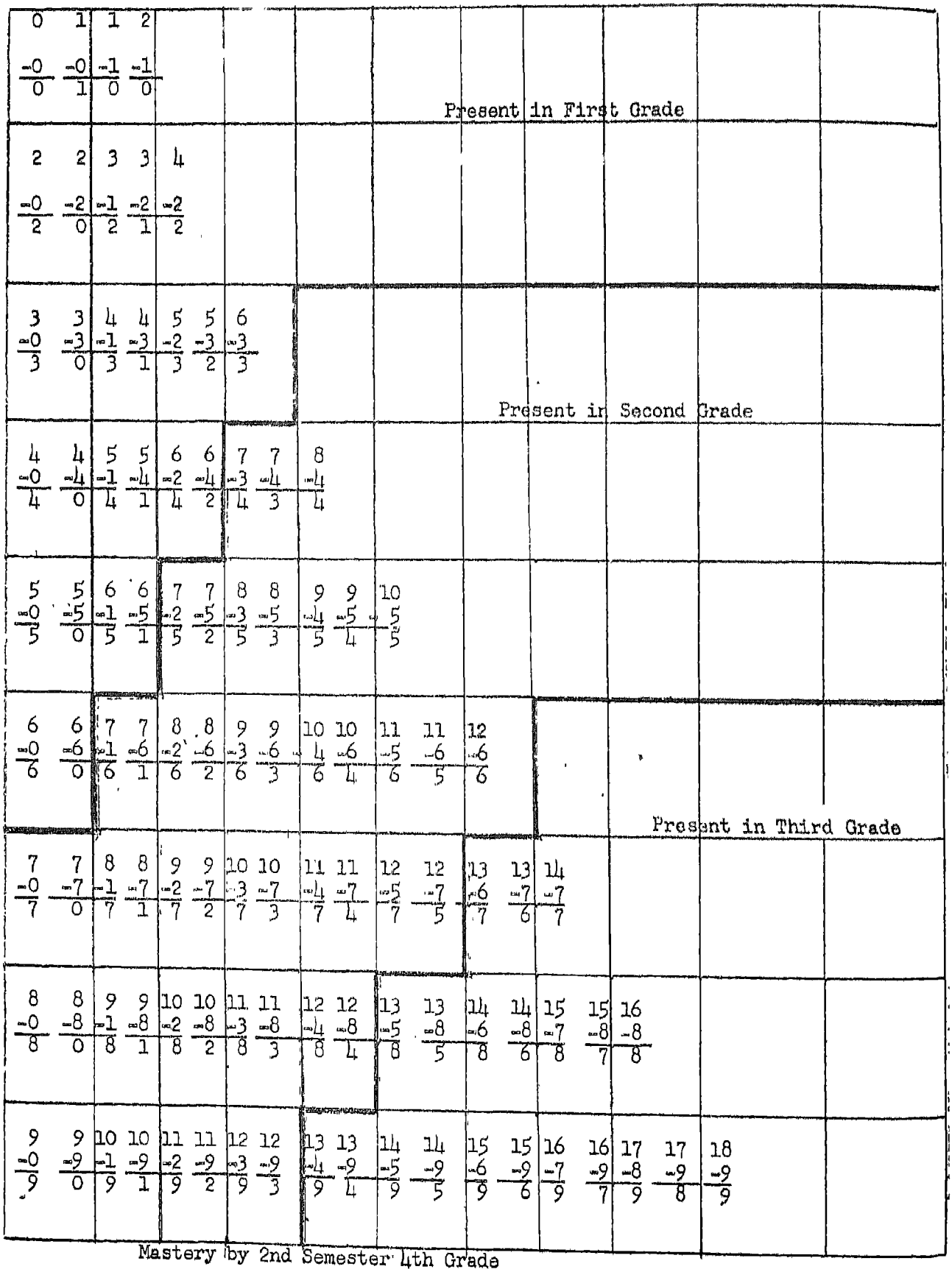
SUGGESTIVE ACTIVITIES	HOW SOME TEACHERS DO IT
Use arithmetical terms with children in developing and practicing arithmetic processes. Establish the habit of labeling (naming) answers. Check occasionally to see that children understand the terms being used.	

APPENDIX

100 Basic Addition Facts
Appendix



100 Basic Subtraction Facts
Appendix



SUGGESTIONS FOR USING NUMBER SQUARES

Grade One

To develop the concept that a number is an aggregate of ones and that some numbers mean more or less than other numbers.

Materials

For the teacher--a felt board with 55 felt squares, or a chalkboard or chart on which to draw

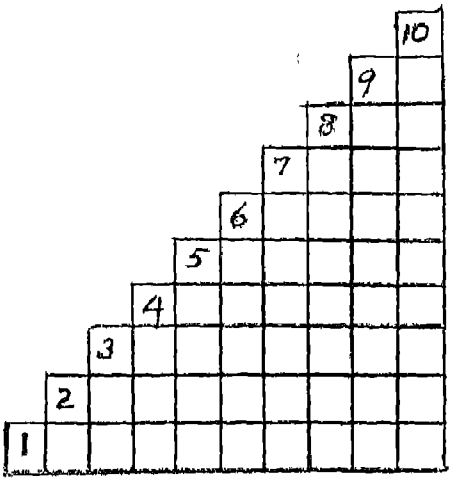
For the child--55 tagboard squares

Procedure

Children work with squares on desk as teacher works on felt board, chalkboard, or chart

Starting with one square, teacher and pupils work together to build a number-stairs of 10

A step-by-step discussion of the procedure should include such questions as, "The third stair is how much higher than the second step?--How many more is 6 than 5?--What number is one more than 8?"



Arrive at the general observation that counting is like going up stairs one step at a time. Each stair step is one step higher than the one before it. Each number means one more than the number before it.

Follow Up Activities

Use the squares from the 2nd step (or 3rd, 4th, and the like) to discover the grouping patterns of that particular number.

Tagboard duplicates of this sheet are available. Order by stock number. Three sheets for each pupil should be enough for class activities. Tear along perforated lines, cut along solid lines.

SUGGESTIONS FOR USING STRIP COUNTERS

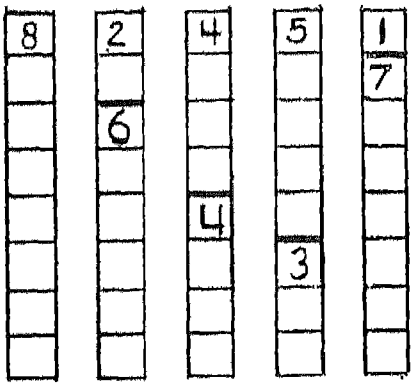
To develop concepts and understandings in the four processes with numbers through 10, for example, 8

Materials

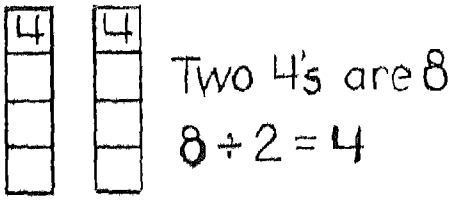
Strip counters for each pupil in sufficient quantity for the particular lesson

Procedure

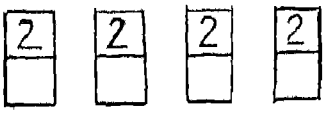
To show the addition facts of 8, have pupils lay the 8-strip counter on their desks. Place combinations of other strip counters which total 8 parallel to the 8-strip to show all the possibilities for making 8



To show the subtraction facts of 8, reverse the procedure. Remove one part of each combination of strip counters to show what is left when one of the parts of 8 is taken away.



To show the multiplication facts of 8, use two 4-strip counters and four 2-strip counters. Show that the products are the same, although the groups combined are different.



Four 2's are 8

8 ÷ 2 = 4

To show the division facts of 8, use the same strip counters as for multiplication. Show that 2 groups of 4 can be taken out of 8 and also 4 groups of 2. Call attention to the fact that although the products in multiplication are the same in related facts, the quotients are different. Follow-up activities may show 2 X 3 = 6, 3 X 2 = 6, 6÷3=2, 6÷2=3, and so on for all numbers 2 through 10.

DENVER PUBLIC SCHOOLS

Arithmetic Strip Counters

Stock Number 93039

Cut on double lines

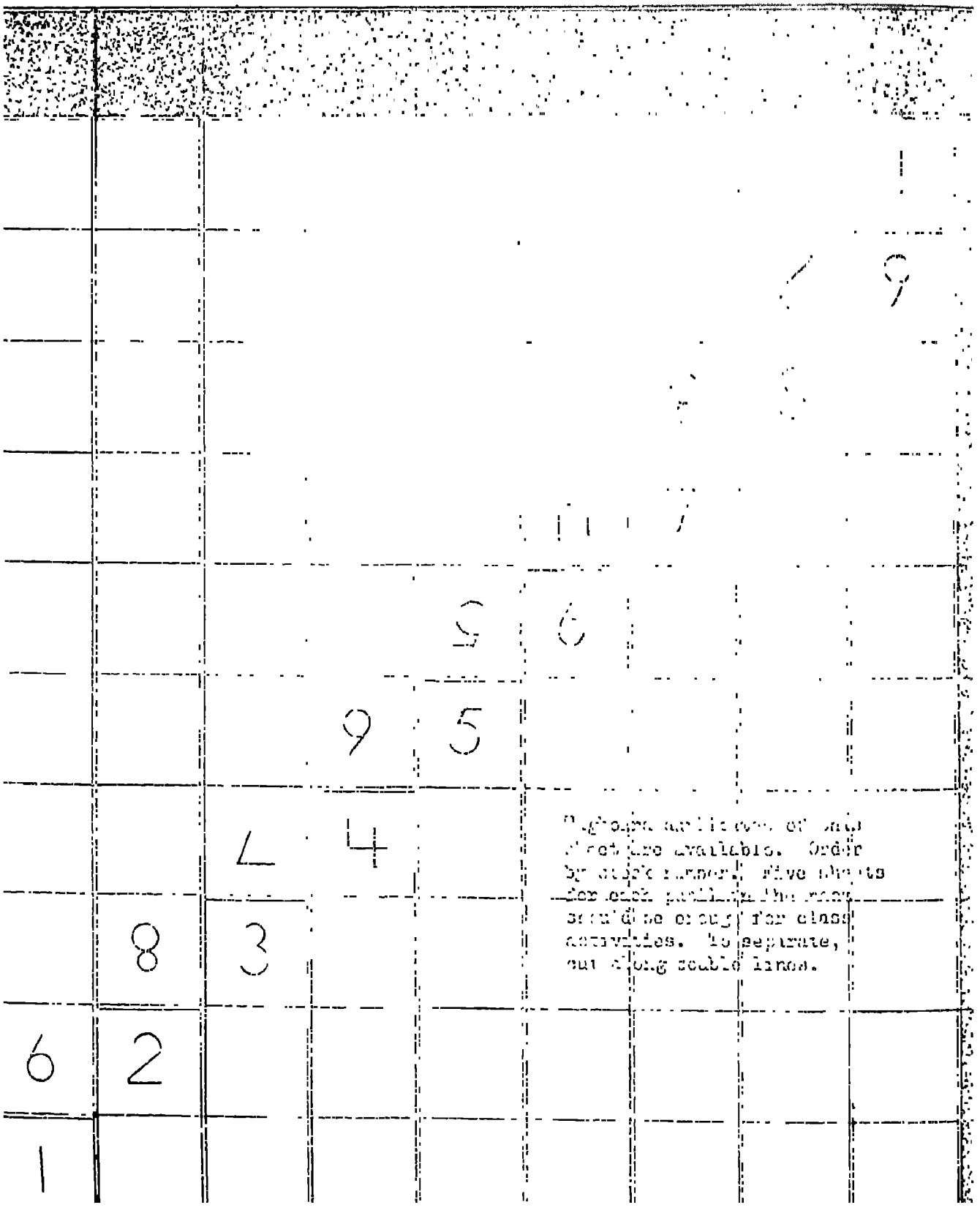
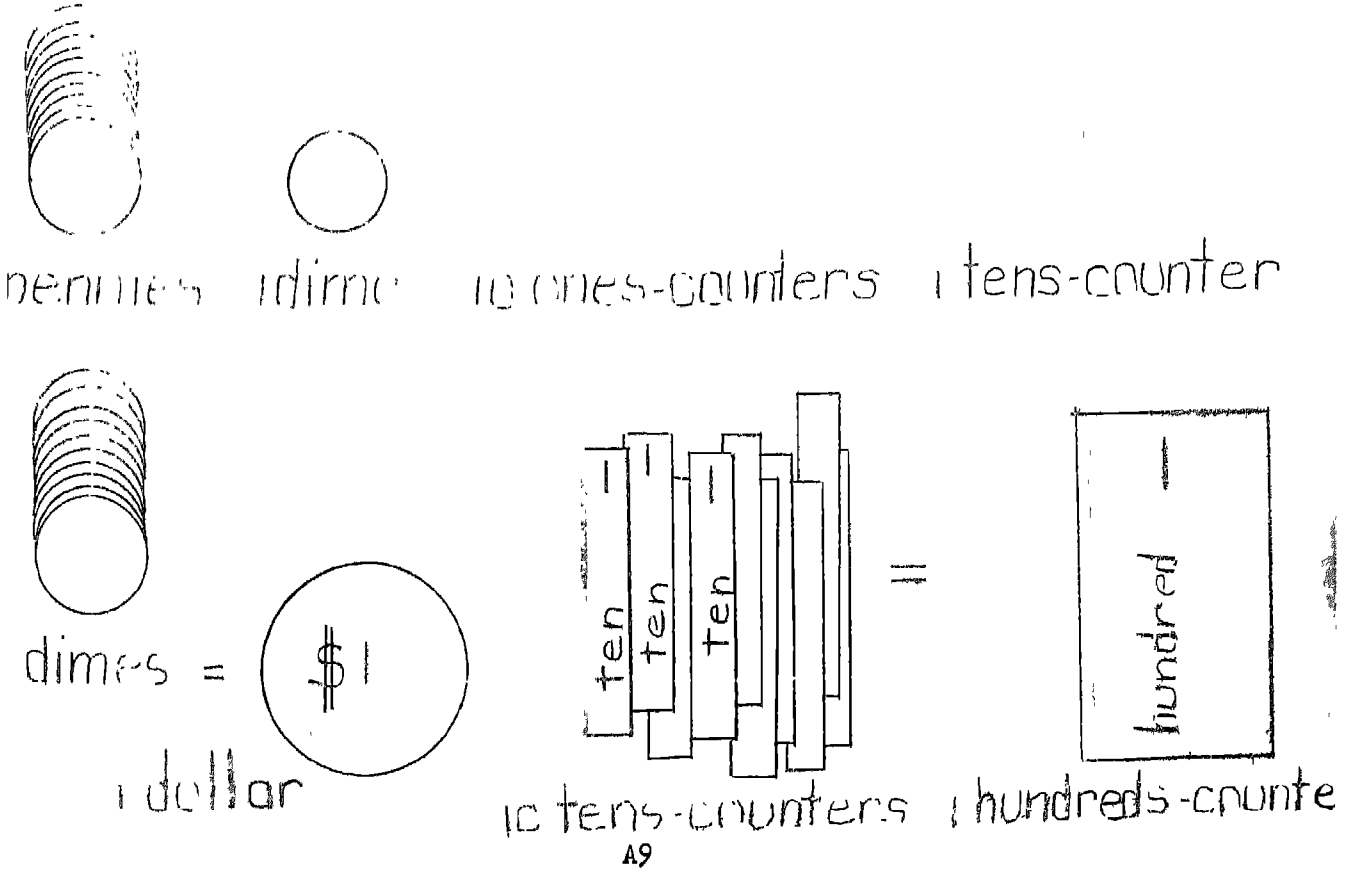


Diagram [illegible] of this sheet are available. Order by stock number. Five sheets for each [illegible] should be enough for class activities. To separate, cut along double lines.

PLACE VALUE COUNTERS AND POCKET CHART

Our money system is a true example of the decimal nature of our number system. This fact, together with the natural interest children have in money, makes it a desirable medium for leading into the study of our number system, place value, and the grouped and regrouped values of numbers.

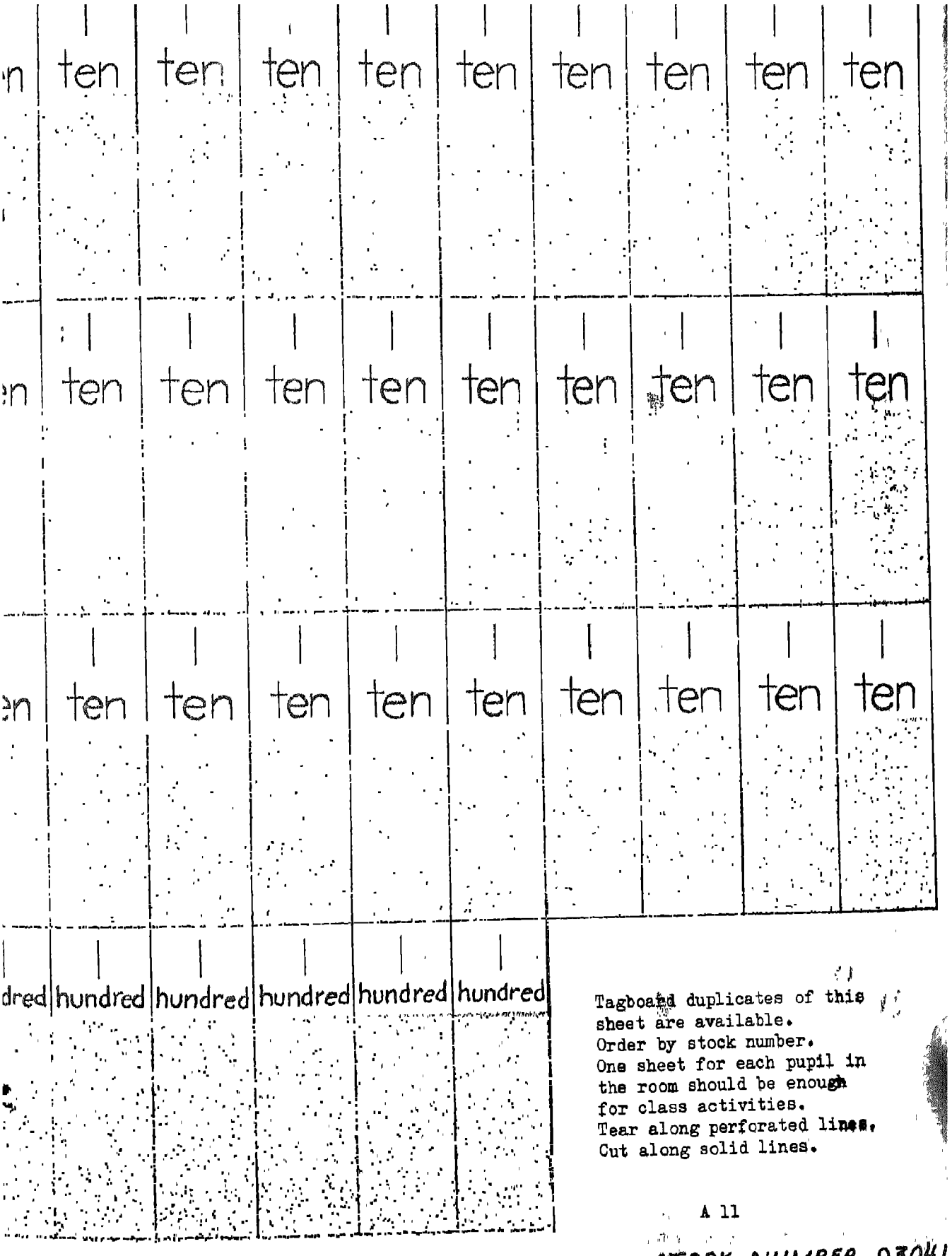
The grouped value of $1.39 is one dollar, 3 dimes, and 9 pennies. This the child can see, feel, and understand. His experiences in real life situations have given him concepts of regrouping these values: 10 pennies for 1 dime, 10 dimes for 1 dollar, and vice versa. The teacher has many opportunities for extending this concept of a 10-to-1 and a 1-to-10 ratio in money values, so that the pupil may come to understand that $1.39 may be 139 pennies, 13 dimes and 9 pennies, 10 dimes and 39 pennies and so on. This concept of 10-to-1 and 1-to-10 ratio must be kept consistent when the grouped and regrouped values of numbers are presented, if confusion in the mind of the child is to be avoided. Just as we cannot correctly call 10 pennies with a rubber band around them a dime, neither can we call ten ones-counters bundled together with a rubber band a ten. They are just what they appear to be--a bundle of 10 ones. Numbers are abstract ideas. They may be represented by symbols called digits and by representative materials called counters. Numbers cannot be bundled. They can be thought of in grouped values and regrouped valu To keep the representational step of developing the regrouping of numbers consistent with the abstract stage the learner is striving for, place value counters are provided for pupil-teacher use. Detailed suggestions for using them are to be found in the body of this book, pp. <u>1x - XIII</u> and pp. <u>A5 - A13</u> of the Appendix.



one	one	one	one	one	one	one	one	one
one	one	one	one	one	one	one	one	one
one	one	one	one	one	one	one	one	one
one	one	one	one	one	one	one	one	one

Arithmetic Ones Counters

Tagboard duplicates of this sheet are available.
Order by stock number.
One sheet for each pupil in the room should give enough counters for class activities.
Tear along perforated lines.
Cut along solid lines.



Tagboard duplicates of this sheet are available.
Order by stock number.
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Tear along perforated lines.
Cut along solid lines.

A 11

'THMETIC TENS AND HUNDREDS COUNTERS

STOCK NUMBER 93041

ONES

Directions for making individual pocket charts:

Fold up on dotted line. Staple ends and solid lines to form pockets.

TENS

FOLD HERE

HUNDREDS

Tagboard duplicates of this sheet are available. Order them by stock number. One for each pupil in the room should be sufficient.

Stock Number 93042

Arithmetic Place Value Pocket

A12

Developing the Understanding of Place Value
The Teen Numbers
Grade I

To extend the grouping concept to the numbers 11 through 19 by developing the relationship of each number to 10 in readiness for place value in our number system

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Readiness

Understanding of the numbers 1 through 10
Sequence: 3 comes after 2 and before 4 and between 2 and 4
Enumerative value: 3 denotes an aggregate of 3 things
One-to-one correspondence: 3 pencils are needed for 3 people

Grouping patterns: □ □ □ is □ □ and □ ; □ □ □ is □ and □ □

Rational counting through 19

Materials

Minimum of 19 objects per pupil for grouping

Visual aids for teachers such as flannel board, simple abacus, or bead frame

Procedure

Utilize any one of the innumerable social situations common to first grade classroom activities to launch the study of teen numbers such as counting 17 pennies by arranging a row of 10 and a row of 7
Show by manipulative activities each teen number as one group of 10 and one group of some more

/ / / / / / / / / / / / / 13 is one group of 10 and one group of three

Delay the concept that 13 is 3 more than 10; also delay the terminology tens and ones at this stage

Follow-up Activities

Follow the initial lesson with many successive lessons which give experience in matching symbols with groupings, recognition of groupings, and reproducing groupings of teen numbers with emphasis on one group of ten and one group of as many as is needed to yield the desired number. Then extend the grouping to two groups of ten and one group of some more (20-29), then to three groups of ten and one group of some more (30-39), four groups of ten and one group of some more (40-49). Build the concept of a group of ten and a group of multiples of 10; 10, 20, 30, 40; 44 is 4 groups of 10 and 1 group of 4.

Meaning and Value of Numbers
Regrouping
Grade 2

To develop the concept of the relation between a group of ten and 1 ten as denoted by tens place in our number system; to develop the concept of ones place and tens place

Readiness

An understanding of the relation of the teen numbers to 10, and of the relation of 10 pennies to one dime and the reverse

Materials

Pennies and dimes, one-counters and ten-counters

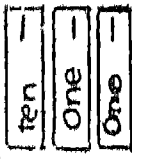
Procedure

Launch through actual classroom situation with money

Show with pennies that any teen number is one group of ten pennies and one group of more pennies

Show that 1 dime can be used in the place of the group of 10 pennies

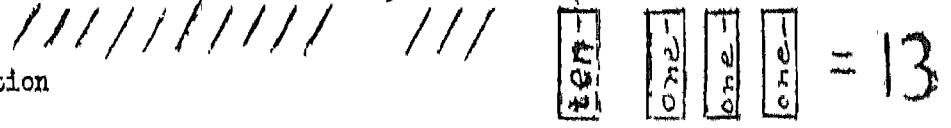
Show that any teen number is a group of 10 one-counters and some more one-counters



Show that one tens-counter can be used in the place of the group of 10 ones-counters

Observe that the pennies to the right of the dime and the one-counters to the right of the ten-counter are not replaced. Point out that these are called ones because they are less than ten

Recall that in all the work with the teen numbers the ten group was on the left. Establish that in a teen number the 1 shows the one ten and the number to the left shows how many ones are to be combined with the ten



Generalization

The place to the left in a 2-place number is called tens place and the place to the right is called ones place, so we can say that in 13 there are 1 ten and 3 ones.

Follow-up Activities

Give many varied experiences with representative materials and many abstract experiences enriched by a sufficient variety of teaching devices to accomodate the individual differences and abilities of the children

Extend and enrich the concept of tens place and ones place through a similar study of the numbers 20-30, then 30-40. Show that tens place is used for 1 ten and for multiples of ten through 9 tens

Meaning and Value of Numbers
Regrouping
Grade 2

To develop the concept of the grouped and ungrouped value of 2-place numbers in the ratio 1 to 10 and 10 to 1

Readiness

Understanding of tens place and ones place

Materials

Pennies and dimes, one-counters and ten-counters, pocket chart

Procedure

Through a classroom situation involving the exchanging of a dime for 10 pennies or the reverse, show that place value is flexible but that the ratios 10 to 1 (L to R) and 1 to 10 (R to L) are maintained.

Use pennies and dimes with the abstract symbols

Show that when 10¢ is represented by a dime, it is written in dimes place (a); that when 10¢ is represented by pennies it is written in pennies place (b).

	DIMES	PENNIES
(a)	1	0
(b)		10

Use an abacus, bead frame, or a pocket chart with ones-counters and tens-counters to show that when ten is represented by a tens-counter, it is written as 1 ten and 0 ones (a)
That when 10 is represented by 10 ones-counters, it is written in ones place as 10 ones (b)

	TENS	ONES
(a)	1	0
(b)		10

Follow-Up Activities

Extend the study of grouped and ungrouped value of digits in tens and ones place through numbers 10 to 99

Combine the use of representative materials (money, counters) with abstract symbols, recording on dimes and pennies charts and on tens and ones charts

Place Value
Hundreds, Tens and Ones Places
Grade 3

To develop the understanding of hundreds place as ratio of 10 to 1 (L to R) and 1 to 10 (R to L) and of regrouping the value of digits in the same ratio

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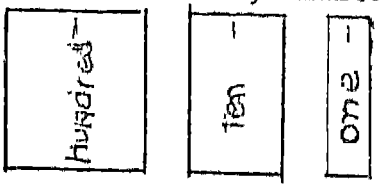
Readiness

Facility in using ones and tens place with understanding in the process of addition and subtraction involving regrouping

Materials

Dollars, dimes and cents, hundreds-counters, tens-counters, and ones-counters



Procedure

Use a classroom situation involving money to show the ratio of 10 to 1 from dimes to dollars

Write money under the headings dollars, dimes, cents (a)
Substitute hundreds-counters for dollars, tens-counters for dimes, ones-counters for cents (nickels or pennies) and show hundreds place, tens place, ones place
Show regrouping values of digits with money and counters. b,c,d,e (a)(b)(c)

	Dollars	Dimes	cents
(a)	1	8	9
(b)		18	9
(c)			189
(d)		10	89
(e)	1		89

	Hundreds	Tens	Ones
(a)	1	8	9
(b)		18	9
(c)			189

Generalization

Our number system is a place-value system in which grouping by tens is the basic idea. Ratios of 1 to 10 and 10 to 1 are maintained throughout all activities with place value.

Follow-Up Activities

Extend the understanding of regrouping the value of digits through addition and subtraction examples requiring the regrouping in ones place, tens place, hundreds place, and in more than one place

Abacus, bead frame, pocket chart, or other visual aids

Regrouping from Tens Place
Grade 3

To develop the understanding that regrouping values of digits from one to tens is necessary in addition when the sum of the ones is more than 9

Readiness

Understanding of regrouping the values of the digits in tens and in ones place

Procedure

Use money to show the conversion of ones to tens in such an example as $\begin{array}{r} 13¢ \\ +19¢ \end{array}$

13¢ = 1 dime and 3 pennies
19¢ = 1 dime and 9 pennies
(2)(12) = 2 dimes and 12 pennies

Show that 9 is the largest number of ones we can write in ones place if our answer is to be sensible

Evolve that 12 pennies can be regrouped into 10 pennies and 2 pennies. The 10 pennies can be exchanged for 1 dime and written with the 2 dimes in tens place, making 3 dimes 2 pennies for the answer

12 pennies = 1 dime and 2 pennies
2 dimes
+1 dime and 2 pennies
3 dimes and 2 pennies = 30¢ + 2¢ = 32¢

Use one-counters and ten-counters similarly to develop concept of regrouping in such examples as $\begin{array}{r} 13 \\ +19 \end{array}$

13 = (Grouping) 1 tens-counter and 3 ones-counters =
+19 + 1 tens-counter and 9 ones-counters
(Regrouping) 10 ones-counters and 35 one-counters =
+10 ones-counters and 9 ones-counters
20 ones-counters and 12 ones-counters =
(Regrouping) 3 tens-counters and 2 ones-counters
30 + 2 = 32

Follow-Up Activities

Give meaningful practice in the understanding developed above

Regrouping from Tens and Hundreds Places
Grade 3

To extend the use of regrouping in the processes of addition and subtraction to 2- and 3-place numbers

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Readiness

Understanding of regrouping the values of digits in ones, tens, and hundreds places

Procedure

Use one-counters, ten-counters, hundred-counters to show regrouping of digits from grouped values to regrouped values

I. Regrouping from tens place

grouped values

63 — 6 tens-counters and 3 ones-counters
-27 — 2 tens-counters and 7 ones-counters
36

regrouped values

5 tens-counters and 13 ones-counters
-2 tens-counters and 7 ones-counters
3 ten-counters and 6 one-counters = 30 and 6 = 36

II. Regrouping to hundreds place

grouped values

242 — 2 hundreds-counters and 4 tens-counters and 2 ones-counters
+173 — +1 hundreds-counter and 7 tens-counters and 3 ones-counters
415 — 3 hundred-counters and 11 ten-counters and 5 one-counters

(Regrouped values, regrouping 11 ten-counters to 1 hundred-counter and 1 ten-counter)

4 hundred-counters, 1 ten counter and 5 one counters = 415

III. Regrouping from tens place

385 =
-146 — 3 hundreds-counters, 8 tens-counters, 5 ones-counters
-1 hundreds-counters, 4 tens-counters, 6 ones-counters =

3 hundreds-counters, 7 tens-counters, 15 ones-counters
-1 hundreds-counters, 4 tens-counters, 6 ones-counters = 239
2 hundred-counters, 3 ten-counters, 9 one-counters

IV. Regrouping from hundreds and tens places

424 = 4 hundreds-counters, and 2 tens-counters, and 4 ones-counters =
-147 -1 hundreds-counters, and 4 tens-counters, and 7 ones-counters

3 hundreds-counters, and 12 tens-counters, and 4 ones-counters =
-1 hundreds-counters, and 4 tens-counters, and 7 ones-counters

3 hundreds-counters, and 11 tens-counters, and 14 ones-counters = 277
-1 hundreds-counter, and 4 tens-counters, and 7 ones-counters
2 hundreds-counters, and 7 tens-counters, and 7 ones-counters

Addition Practice Material

Directions

Provide each child with a strip of 3" x 12" ruled paper for each exercise.

Number the paper from 1 to 20. Have the children write the answers only. Have children put a check (✓) on the line when the answer is unknown.

If using as a test, dictate a new fact every 5 seconds. For practice, time may be varied for the individual class.

Sums less than 10

1. 5 and 3 are ___
2. 3 and 0 are ___
3. 4 and 2 are ___
4. 6 and 3 are ___
5. 5 and 1 are ___
6. 2 and 7 are ___
7. 4 and 4 are ___
8. 2 and 2 are ___
9. 5 and 4 are ___
10. 6 and 1 are ___
11. 0 and 1 are ___
12. 5 and 2 are ___
13. 1 and 1 are ___
14. 3 and 2 are ___
15. 4 and 1 are ___
16. 3 and 3 are ___
17. 7 and 2 are ___
18. 3 and 1 are ___
19. 3 and 4 are ___
20. 8 and 1 are ___

Sums less than 10

1. 3 and 4 are ___
2. 8 and 1 are ___
3. 3 and 3 are ___
4. 7 and 2 are ___
5. 3 and 1 are ___
6. 3 and 2 are ___
7. 1 and 1 are ___
8. 5 and 2 are ___
9. 4 and 1 are ___
10. 5 and 3 are ___
11. 3 and 0 are ___
12. 4 and 2 are ___
13. 6 and 3 are ___
14. 5 and 1 are ___
15. 2 and 7 are ___
16. 4 and 4 are ___
17. 5 and 4 are ___
18. 2 and 2 are ___
19. 6 and 1 are ___
20. 0 and 1 are ___

Addition Practice Material

Sums more than 10

1. 9 and 1 are ___
2. 6 and 5 are ___
3. 8 and 4 are ___
4. 5 and 9 are ___
5. 6 and 4 are ___
6. 7 and 3 are ___
7. 4 and 9 are ___
8. 6 and 8 are ___
9. 9 and 6 are ___
10. 7 and 7 are ___
11. 5 and 8 are ___
12. 8 and 9 are ___
13. 7 and 8 are ___
14. 9 and 2 are ___
15. 6 and 6 are ___
16. 8 and 3 are ___
17. 5 and 7 are ___
18. 7 and 4 are ___
19. 6 and 7 are ___
20. 9 and 9 are ___

Sums more than 10

1. 7 and 7 are ___
2. 9 and 6 are ___
3. 6 and 8 are ___
4. 4 and 9 are ___
5. 7 and 3 are ___
6. 6 and 4 are ___
7. 5 and 9 are ___
8. 8 and 4 are ___
9. 6 and 5 are ___
10. 9 and 1 are ___
11. 5 and 8 are ___
12. 7 and 8 are ___
13. 8 and 9 are ___
14. 9 and 2 are ___
15. 6 and 6 are ___
16. 8 and 3 are ___
17. 5 and 7 are ___
18. 7 and 4 are ___
19. 6 and 7 are ___
20. 9 and 9 are ___

1. 9 and 7 are ___
2. 2 and 3 are ___
3. 2 and 7 are ___
4. 5 and 9 are ___
5. 6 and 7 are ___

Sums less than 10 and more than 10

6. 4 and 5 are ___
7. 3 and 6 are ___
8. 6 and 6 are ___
9. 8 and 7 are ___
10. 5 and 6 are ___
11. 6 and 9 are ___
12. 4 and 7 are ___
13. 6 and 3 are ___
14. 8 and 3 are ___
15. 7 and 2 are ___
16. 5 and 4 are ___
17. 6 and 8 are ___
18. 4 and 9 are ___
19. 3 and 2 are ___
20. 7 and 6 are ___

Subtraction Practice Material

Directions

Provide each child with a strip of 3" x 12" ruled paper for each exercise.

Number the paper from 1 to 20. Have the children write the answers only. Have children put a check (✓) on the line when the answer is unknown.

If using as a test, dictate a new fact every 5 seconds. For practice, time may be varied to the needs of the individual class.

Minuends less than 10

1. 5 from 7 ____
2. 7 from 9 ____
3. 3 from 8 ____
4. 2 from 6 ____
5. 5 from 9 ____
6. 1 from 6 ____
7. 3 from 4 ____
8. 2 from 8 ____
9. 4 from 7 ____
10. 2 from 9 ____
11. 3 from 5 ____
12. 4 from 9 ____
13. 6 from 8 ____
14. 3 from 9 ____
15. 5 from 8 ____
16. 6 from 9 ____
17. 4 from 6 ____
18. 2 from 7 ____
19. 1 from 4 ____
20. 3 from 7 ____

Minuends less than 10

1. 1 from 8 ____
2. 3 from 7 ____
3. 4 from 8 ____
4. 6 from 9 ____
5. 4 from 7 ____
6. 3 from 9 ____
7. 7 from 8 ____
8. 2 from 3 ____
9. 4 from 5 ____
10. 2 from 9 ____
11. 5 from 9 ____
12. 6 from 7 ____
13. 5 from 8 ____
14. 3 from 4 ____
15. 1 from 6 ____
16. 4 from 9 ____
17. 3 from 7 ____
18. 1 from 7 ____
19. 7 from 9 ____
20. 3 from 8 ____

Subtraction Practice Material

Minuends 10 or more

1. 6 from 13 ____
2. 9 from 14 ____
3. 5 from 13 ____
4. 7 from 15 ____
5. 8 from 13 ____
6. 9 from 17 ____
7. 8 from 15 ____
8. 3 from 11 ____
9. 7 from 16 ____
10. 9 from 13 ____
11. 6 from 14 ____
12. 7 from 13 ____
13. 8 from 15 ____
14. 8 from 14 ____
15. 5 from 14 ____
16. 8 from 17 ____
17. 6 from 15 ____
18. 4 from 13 ____
19. 7 from 12 ____
20. 9 from 16 ____

Minuends 10 or more

1. 9 from 18 ____
2. 8 from 14 ____
3. 2 from 11 ____
4. 9 from 18 ____
5. 7 from 14 ____
6. 3 from 12 ____
7. 6 from 13 ____
8. 5 from 15 ____
9. 8 from 17 ____
10. 9 from 13 ____
11. 6 from 15 ____
12. 7 from 16 ____
13. 4 from 11 ____
14. 7 from 16 ____
15. 9 from 17 ____
16. 4 from 12 ____
17. 5 from 14 ____
18. 9 from 12 ____
19. 7 from 13 ____
20. 6 from 11 ____

Minuends less than 10 and 10 or more

1. 8 from 12 ____
2. 3 from 7 ____
3. 8 from 11 ____
4. 9 from 17 ____
5. 2 from 8 ____
6. 5 from 9 ____
7. 3 from 10 ____
8. 4 from 10 ____
9. 8 from 17 ____
10. 6 from 15 ____
16. 9 from 15 ____
17. 4 from 12 ____
18. 7 from 15 ____
19. 8 from 17 ____
20. 5 from 14 ____
11. 9 from 14 ____
12. 8 from 17 ____
13. 4 from 9 ____
14. 8 from 16 ____
15. 3 from 7 ____

ADDITION

5 000 000 000
8
9

Example A: Addition by "counting on" using dots, circles, or some other device as an aid. Although this is an immature level of operation, it shows a beginning understanding of addition.

5 5
8 8
9 9 (22)
22 7
3 (14)
4
36

Example B: Addition by using primary and higher decade facts. This level of operation is an outgrowth of the mastery of basic facts. The operation is mental and no aids are used. Often children at this level of operation will record partial sums as a memory aid when adding 5 or 6 addends.

2 tens and 5 ones
7 tens and 8 ones
3 tens and 9 ones
12 tens and 22 ones

120 and 22 = 142

Example C: Recording the addends and sum as grouped and regrouped numbers. This is an inefficient level of operation with two-place addends. However, the ability to use it shows a comprehension of place value.

25
78
39
22
120
142

Example D: Recording partial sums for ones and tens. The ability to operate at this level shows a good comprehension of place value. It is more mature than example C and leads naturally to example E which follows.

2
25
78
39
142

Example E: Recording the "carry figure." This level shows a good level of operation except that the carry fact is written. A more mature, desirable, and efficient level is to do the addition without recording the carry figure.

25
78 → 90 + 13 = 103
39 → 103 + 30 = 133 + 9 = 142 (adding tens and ones at the same time)

or

20 + 70 + 30 = 120 + 22 = 142 (adding the tens first, then the ones)

Example F: Mental addition. The tens and ones are added simultaneously or the tens are added first. This is a high level of operation which is very efficient when mastered.

SUBTRACTION

$\begin{array}{r} 9 \\ -4 \\ \hline \end{array}$ 0000

$\begin{array}{r} 17 \\ -\ 8 \\ \hline \end{array}$ 00000000

Example A: Subtraction by "counting backwards," using dots or marks. Although this is an immature level of operation it shows a beginning understanding of subtraction.

$\begin{array}{r} 42 \\ -28 \\ \hline \end{array}$ 4 tens and 2 ones = 3 tens and 12 ones
2 tens and 8 ones = 2 tens and 8 ones
1 ten and 4 ones = 14

Example B: Recording the algorism as grouped and regrouped numbers. This level though inefficient shows an understanding of place value and of regrouping of numbers.

$\begin{array}{r} 42 \\ -28 \\ \hline \end{array}$ $\begin{array}{r} 42 \\ -20 \\ \hline 22 \\ -\ 8 \\ \hline 14 \end{array}$

Example C: Recording a partial remainder. This level shows an understanding of the "ten-ness" of the number system, and is a step toward the standard algorism.

$\begin{array}{r} 42 \\ -28 \\ \hline \end{array}$ $\begin{array}{r} 3\ \ 12 \\ \not{4}\ \ \not{2} \\ -\ 2\ \ 8 \\ \hline 1\ \ 4 \end{array}$

Example D: Recording the regrouping necessary. This level of operation shows a thorough understanding of regrouping, but a need for visualizing the changing of values.

$\begin{array}{r} 42 \\ -28 \\ \hline 14 \end{array}$

Example E: The algorism in its standard form without recording the regrouping.

"28 and 2 are 30, 10 more are 40, 2 more 42, then answer is 2 + 10 + 2 = 14"

Example F: The recording is the same as in example E. However, it represents a mental operation based on finding the distance from one number to another. In this operation no regrouping is necessary.

MULTIPLICATION

321	0		00		000		
x 3	0	3 ones are 3	00	3 twos are 6	000	3 threes are 9	
	0		00		000		
	3						

This level shows a counting process to find the necessary multiplication combinations.

23	23
x 4	23
	23
	-23
	92

Multiplication by addition shows a simple understanding of combining equal groups.

	A.	B.
789	789	789
x 8	8	8
	72	6312
	640	
	5600	
	6312	

Example A: Shows an understanding of the place value of the numbers of the multiplicand, and illustrates the "carrying" involved.

Example B: Shows a more efficient level with "carry facts" visualized.

35	35	35	105	35
x23	x 3	x20	-700	x23
	105	700	805	105
				700
				805

35		Mental operation
x23		
105	or	
706		20 x 35 = 700
805		3 x 35 = 105 equals 805

374	374	374
x304	x304	x304
1496	1496	1496
000	11220	1122
1122	113 696	113 696
113696		

In these examples of 2- and 3-place numbers, different levels of maturity are shown, and can be explained in terms of the other examples.

DIVISION

$3\overline{)17}$ X X X / X X X / X X X / X X X / X X X / X X
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

This level shows a simple understanding of dividing a number into groups of a given size.

$3\overline{)17}$

17 −3 = 14; 14 −3 = 11; 11 −3 = 8; 8 −3 = 5; 5 −3 = 2

17 −15 = 2 (5 threes = 15)

This level shows the subtraction of equal groups concept of division.

$3\overline{)17}$

17 −15 = 2 (5 threes are 15)

This level shows an understanding of the place of multiplication in division.

$3\overline{)17}$

$3\overline{)17}$ 5 r2; 15; 2

$3\overline{)17}$ 5 r2

This is the highest level of operations, the standard algorism and the mental operation.

$3\overline{)49}$

$3\overline{)49}$ 30; 19; 18; 1 — 10; 6; 16 r1

$3\overline{)49}$ 10 16 r1; 30; 19; 18; 1

$3\overline{)49}$ 16 r1; 3; 19; 18; 1

$3\overline{)49}$ 16 r1

Mental operation

"3 fifteens are 45"
"3 sixteens are 48"

"16 r 1 is the answer"

The above examples show levels of operations using a larger dividend.

DENVER PUBLIC SCHOOLS
Division of Instructional Services
Department of Instruction
1956-1957

TO ALL PRINCIPALS, COORDINATORS, AND TEACHERS OF GIFTED PUPILS:

The philosophy of the K-12 Mathematics Program is in agreement with the following statement prepared at the request of the Executive Board of Committee on Instructional Policy by the K-12 Study Committee for the Gifted. All teachers of mathematics should read the statement with the specific goal of making it a guide to their teaching of mathematics to gifted children.

DEMANDS MADE UPON GIFTED PUPILS -

The Executive Board of the Committees on Instructional Policy requested the K-12 Study Committee for the Gifted to clarify its position on the work which may properly be required of pupils in the program for the gifted. The Executive Board's request stems from concerns expressed by teachers, pupils, and parents about the quality of work involved in home assignments and the time required to do these assignments.

This statement is submitted in response to that request. It represents views implicit in the Committee's Report to the Board of Education, which is the official statement of present policy.

The committee's studies do not reveal any reason that gifted pupils should work harder or longer than other pupils. Rather, their assignments should be such as to stimulate them to achieve the superior quality of learning of which they are capable.

This difference in quality does not result from an increased work load: more pages to be read or written, more examples to be worked, more notebooks to be assembled. It does result from a higher quality of learning experience.

The following questions ought to be asked about the instruction of every gifted pupil:

1. Do his lessons cause him to draw conclusions, state generalizations, see relationships, build concepts, and apply basic principles?

2. Is he taught how to use the scientific method as a process for solving problems, not only in the field of science but also in other areas of study?

3. Does he have opportunities, time, and materials to do creative work of his own kind?

4. Is he being taught how to study independently on a level appropriate to his age?

5. Is his capacity for sustained interest being developed by assignments which cover a longer period of time and which he has shared in planning.

6. Is his school time being conserved properly by excusing him from those parts of the regular work which he already knows?

7. Is he taught how to make the best use of his time, particularly in undertaking only as much as he should do, in avoiding last-minute accumulations of work, and in utilizing spare time at school in preference to taking work home?

8. Is he being taught to develop those habits, attitudes, understandings, and skills which will enable him to work and plan well with age mates whose abilities and interests are less mature?

The committee believes that a youngster who meets all the criteria for the gifted (see page 25 of the committee's report to the Board of Education) should reach the level of achievement indicated for him by our Expectancy Tables. If his learning experiences have been made qualitatively different, as indicated above, he should attain this goal and at the same time find his school experience so stimulating and satisfying that he will be enthusiastic about school and eager to continue his education.

DENVER PUBLIC SCHOOLS
Division of Instructional Services
Department of General Curriculum Services
1957-1958

Arithmetic Project 3.1 . Stock Number 91999
Number System

Introduction

The purpose of this project is to help pupils summarize and evaluate their understanding and use of our number system and to give suggestions for reteaching where it is needed.

It is suggested that these tests be given during the first 2 weeks of the first 9-weeks period; that they be followed with reteaching as indicated by analysis of the results and that the tests be given again at the end of the semester.

Administration of the Tests

Have all children begin each test at the same time making sure that all children understand the directions for performing and marking each item of the test. (The teacher may read, but should not interpret individual items to the class). Collect the papers when three-fourths of the class have finished.

Analysis of Errors

1. After the test has been scored, an error count by items can be made by having each child write on a slip of paper the number of items missed. By compiling these the teacher can tell which items presented the greatest difficulty to the class. Experience indicates that when one-third of the class miss an item, the whole class as well as the individuals missing the item will profit by a reteaching of the basic understanding tested by the item.

2. For purposes of analyzing a group's strengths and weaknesses in the concept and understanding of our number system, items of the tests may be grouped under the following headings:

Test 1

Sequence of numbers 1, 6, 7
Counting by rote 1, 2, 3, 4, 5, 8
Multiples of groups 2, 3, 4, 5, 8
Zero as a starting place 1
Zero as not any 10, 12
Ordinals as designating position 11 (a)
Ordinals as designating which one 11 (b)
Decades 13
Zero as a place holder 9

Test 2

Structure of numbers 1, 2, 10
Meaning and value of numbers 3, 4, 5, 6, 7, 8, 9, 11
Zero as place holder 1, 2, 3, 4, 5

Test 3

Position of tens and ones place 1, 2, 3
Grouped and regrouped values of numbers 5, 6, 7, 9, 10
Understanding of 10 to 1 or 1 to 10 ratio of each place, 5, 6, 7, 9, 10, 14
Understanding 9 as maximum frequency of digits in any place 4, 11, 12, 13

Materials for reteaching are given in the outline and content of the handbook and in the sample lessons on Place Value in the Appendix.

Arithmetic Project 3.1 Number System

Test 1 Knowledge of Number, Number Sequence

(0)	(10)	(20)	(30)	(40)	(50)	(60)	(70)	(80)	(90)
1	(11)	21	31	41	51	61	71	81	91
2	12	(22)	32	(42)	52	62	72	82	(92)
3	(13)	23	33	(43)	(53)	63	73	83	(93)
4	(14)	24	(34)	(44)	54	64	(74)	(84)	94
5	15	(25)	35	(45)	55	(65)	(75)	85	95
6	16	(26)	(36)	46	(56)	(66)	(76)	(86)	(96)
7	17	27	37	47	57	67	(77)	87	97
8	(18)	(28)	38	(48)	58	(68)	78	(88)	(98)
9	(19)	(29)	39	(49)	59	69	79	89	(99)

1. Write the numbers that are missing in the number chart above.
2. Write the numbers you say when you count by 10's to 100.

   (10) (20) (30) (40) (50) (60) (70) (80) (90) (100)

3. Write the numbers you say when you count by 2's from 20 to 50.

   (20) (22) (24) (26) (28) (30) (32) (34) (36)
   (38) (40) (42) (44) (46) (48) (50)

4. Write the numbers you say when you count by 3's to 30

   (3) (6) (9) (12) (15) (18) (21) (24) (27) (30)

5. Write the numbers you say when you count by 4's to 40

   (4) (8) (12) (16) (20) (24) (28) (32) (36) (40)

6. Write the number that comes before

   80 (79) 69 (68) 100 (99)

7. Write the number that comes after:

100 (101) 49 (50) 8 (9)

8. Write the numbers you say when you count to 100 by 5's.

(5) (10) (15) (20) (25) (30) (35) (40) (45) (50)
(55) (60) (65) (70) (75) (80) (85) (90) (95) (100)

9. Write each number as I say it.

(93) (129) (107) (208) (288) (666) (210)

10. Write 5 addition facts about the number 4.

1. (3+1 = 4) 2. (1+3=4) 3. (2+2=4) 4. (0+4 =4)
5. (4+0=4)

11. (a) Put a line under the sixth ball from the left in this row of balls:

(b) Put a line under the word in each sentence that tells which one.

1. Two trees stand in front of the third house from the corner.

2. Mary will be four years old on the twenty-first day of March.

3. One of the most exciting holidays is on the fourth of July.

4. The story of Big Tim starts on page thirty.

12. Write 7 subtraction facts about 6.

1. (6-5 =1) 2. (6-6 =0) 3. (6-3 =3) 4. (6-0=6)
5. (6-1 =5) 6. (6-2 =4) 7. (6-4 =2)

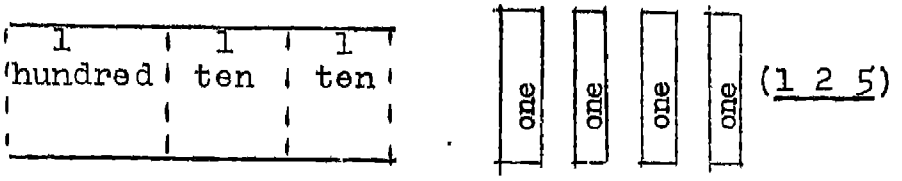
13. Write all the numbers between 49 and 60 in order.

(50) (51) (52) (53) (54) (55) (56) (57) (58) (59)

Test 2. Knowledge of Number, Meaning and Value

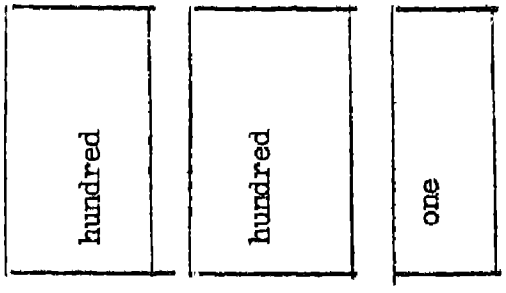
1. Write the numbers which each of these counter pictures tell.

a.



(1 2 5)

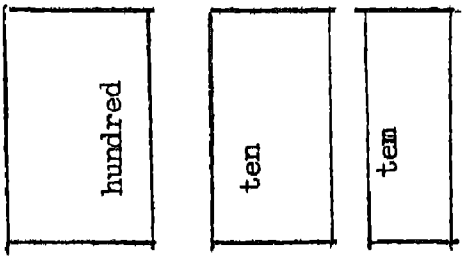
b.



(2 0 1)

c. Ten Ten Four (2 4)

d.



(1 2 0)

2. Write the number which the numbers in each box show.

a.

100
100
10, 10, 10
1, 1, 1, 1

=234

b.

1000
1000
1000
10, 10, 10, 10
1, 1, 1, 1

=3045

c.

10, 10, 10
1, 1, 1

=34

d.

1000
1000
100, 100, 100
1, 1, 1, 1, 1, 1

=2306

3. Write the number that means

a. 2 thousands, 2 hundreds, 3 tens, and 4 ones, (2234)
b. 9 hundreds and 8 tens, (980)
c. 3 tens and 6 ones, (36)
d. 5 hundreds and 6 ones, (506)
e. 3 thousands, 1 hundreds, and 4 ones, (3104)

4. Put a line under the number that means the most.

210, 120, 209, 212

5. Put a line under the number that means the least.

42 322, 116, 240

6. Write the number that means 1 more than

9 (10), 26 (27), 299 (300) 4,256 (4,257)

7. Write the number that means 1 less than

8 (7), 39 (38), 329 (328) 2,678 (2,677)

8. If the 2 in each of these numbers was changed to a 5, which number would then mean the most, a, b, c, or d

(a) 1203, (b) 2453, (c) 1426, (d) 3502 (b)

9. Read the number, then circle the 4 that means less than all the other 4's in the number.

4 440

10. Put a line under the number that has more tens than hundreds in it.

632, 2067, 3127, 489

11. Put a line under the number that means 3 hundred and some more.

31, 237, 300, 243, 307

Test 3. Place Value of Numbers

1. How many dimes and how many pennies are needed to show these amounts of money?

	Dimes	Pennies
13¢	(1)	(3)
16¢	(1)	(6)
10¢	(1)	(0)

2. In the number 19, what does the 1 stand for? (1 ten) The 9? (9 ones)

3. a. In the number 10 what does the 1 stand for? (1 ten) The 0? (no ones)

   b. When the figure 1 stands alone, what does it stand for? (one)

4. What is the largest number of ones you can show in ones place in writing a 3-place number. (9)

5. Show in the box that 19¢ may have two groupings

Dimes	Pennies
19¢ (1)	(9)
19¢	(19)

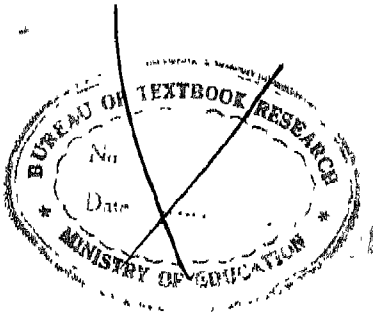
6. Show 2 groupings of 17 in the box.

	Tens	Ones
17	(1)	(7)
17		(17)

7. Show 4 groupings of 37 in the box.

	Tens	Ones
37	(3)	(7)
37		(37)
37	(1)	(27)
37	(2)	(17)

9. In 139 what does the 1 stand for (hundreds) The 3? (tens) The 9? (ones)



9. Regroup the numbers in the box below so that they may be written as a 2 place number.

10, 10, 10, 10

Tens	Ones
5	3

10 10 10
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,

Tens	Ones
(4)	(2)

10. Regroup the numbers in the boxes below so that each may be written as a 3 place number.

(a)

100 100 100 10;10;10;10,10,10 10,10,10,10,10 1, 1, 1, 1, 1 1

Hundreds	Tens	Ones
(4)	(1)	(6)

(b)

10;10;10;10,10 10,10,10,10,10 1, 1, 1, 1,

Hundreds	Tens	Ones
1	0	4

(c)

100 100 100 10,10,10,10,10,10

Hundreds	Tens	Ones
3	6	0

11. What is the largest number of tens you can show in tens place in writing a three place number? (9)

12. What is the largest number of hundreds you can show in hundreds place in writing a four place number (9)

13. The number following any number ending in 9 will always end in (0)

14. Our number system is based on groups of (10)

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